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PROGRESS REPORT ON RESEARCH
IN
HOME ECONOMICS

Including Work in United States Department of Agriculture
and Cooperative Studies with
The State Experiment Stations

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Prepared for Use in Connection with the
July, 1955 Meeting of the
Home Economics Research Advisory Committee

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- This Progress Report is a "tool" for: (1) Advisory Committee use in formulation of recommendations in regard to present and future programs; (2) Administrative use in program development, coordination and evaluation.
- The material in this Report is not for publication. The Report includes research findings that have already been released. When mention is made of these findings, the publication containing the public release is also cited. Any reference to published findings should mention the publication in which the release was made, not this Progress Report. Included also are many tentative findings that have not been sufficiently tested for public release. When results are ready for release, the information will be made available through established channels.
- For the reasons given, copies of the Report are available only to research administrators and workers directly concerned with the development and conduct of the program and to advisory committee members. Those receiving it are asked to observe strictly the limitation: "Administratively Confidential -- (Not to be Quoted or Copied)."

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UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D.C.
June 1955

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FUNCTIONS OF ADVISORY COMMITTEES

The Home Economics Research Advisory Committee is one of a number of committees authorized by Congress in 1946 to advise the Department of Agriculture with respect to specific research and service programs.

The committees have been asked to consider all of the research and marketing service work of the Department in their respective fields. This is in recognition of the value the Department places upon the advice and counsel received and is in accord with suggestions of Congressional committee members who are directly concerned with the work.

These committees are performing an important function in advising with respect to the development of the Department's research and marketing service programs. However, it is recognized by members of Congress, committee members, and the Department that the implementing and administering of these programs are the responsibility of the Department.

The functions of the advisory committee men include:

1. Acquainting themselves with the problems of consumers, producers, all segments of the industry and of other groups, and presenting them for committee consideration.
2. Reviewing and evaluating the current research and marketing service programs of the Department, including work under way at Federal laboratories and field stations.
3. Recommending adjustments in the Department's program, including priorities for new work and expansion of work under way.
4. Developing a better understanding of the nature and value of the agricultural research program, explaining it to interested persons, groups and organizations and encouraging the wider and more rapid application of the findings of research.

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Abbreviations of Agency Names

USDA agencies responsible for conducting or supervising the work covered in this report are indicated by initials as follows:

AMS	Agricultural Marketing Service
ARS	Agricultural Research Service
EU	Eastern Utilization Research Branch (ARS)
HE	Home Economics Research Branch (ARS)
HN	Human Nutrition Research Branch (ARS)
NU	Northern Utilization Research Branch (ARS)
SU	Southern Utilization Research Branch (ARS)
WU	Western Utilization Research Branch (ARS)

COOPERATION

Much of the research on home economics covered in this report is conducted cooperatively by the USDA branches and the State agricultural experiment stations. This cooperative effort usually begins with the inception of the need for a job and extends by joint planning of work programs, cooperation in doing the research job, and, finally, making available the results of the joint effort. The detailed arrangements for the cooperative work vary considerably, depending upon the available facilities, financial support, and personnel and the State policies involved. The cooperative efforts by the USDA and the State stations are planned so as to utilize to the best advantage the personnel and facilities of both agencies and to assure coordination of effort. In most of the reports which follow, the details required to explain specific cooperative relationships is omitted.

INTRODUCTION

Function

The ultimate function of home economics research in the U. S. Department of Agriculture is to provide useful information on this subject for the general public and the rural family. Agriculture is expected to be the authority on the inherent nutritive or other values of its food and fiber products in relation to the health and welfare of consumers, on best methods of household use and care of these products to ensure consumer satisfaction, and on the adequacy of its output of these products to meet health needs and other wants of people, urban and rural. Agriculture also has concern for the kind of living that people on the land can achieve.

Research in human nutrition, begun more than 60 years ago to study the relative utility and economy of agricultural products as food, is of direct value to every man, woman, and child as individual consumers, as well as to rural and urban homemakers in their capacity as the purchasing agents and managers of their families' food. Research on other phases of home economics was begun in 1915 when the establishment of the Extension Service helped to focus attention on their importance. Research on problems other than food and clothing are undertaken primarily with problems of rural families in mind. The principles established by such research are, however, equally applicable to all families -- urban as well as rural.

It is against this frame of reference that a program of home economics research is developed to provide new knowledge about ways to make best consumer use of food, fiber and other agricultural products, and new knowledge about efficient home management. In general, the research undertaken seeks to further knowledge as to:

1. Basic human needs for food, clothing or housing
2. The nature and relative utility or economy of the foods, fabrics and other goods and services available to fulfill these basic needs
3. The use currently made of family resources in providing for living, in order to appraise progress made and to estimate potentials for improvement in living levels through more effective management of resources both on a national and a household basis.

To acquire new knowledge is, thus, the major responsibility of a research staff. The Departmental agency with major responsibility for disseminating information is the Extension Service. But a research staff must put its findings into form for use by this Service and also by other educational groups and public leaders, including schools, social welfare and health agencies, and magazine, press, and radio editors. Some publications are prepared for the homemaker or ultimate consumer. Much of the research also provides results that producers or processors can use in putting on the market products better adapted to the needs of consumers.

Authorization

The Department of Agriculture is directed by law to acquire and diffuse useful information on agricultural subjects in their most general and comprehensive sense. Of the researches that have been specifically authorized by legislation home economists are chiefly concerned with those that promote the utilization of agricultural products for the health and welfare of consumers and those that contribute to better rural homes and rural life.

In the 1946 amendment to the 1935 Bankhead-Jones Act, which provided for research into basic laws and principles relating to agriculture, the Congress declared it to be its policy "to promote the efficient production and utilization of products of the soil as essential to the health and welfare of our people and to promote a sound and prosperous agriculture and rural life. . . For the attainment of these objectives, the Secretary of Agriculture is authorized and directed to conduct and to stimulate research into the laws and principles underlying the basic problems of agriculture in its broadest aspects, including, but not limited to: . . .

"Research into the problems of human nutrition and the nutritive value of agricultural commodities, with particular reference to their content of vitamins, minerals, amino and fatty acids, and all other constituents that may be found necessary for the health of the consumer and to the gains or losses in nutritive value that may take place at any stage in their production, distribution, processing, and preparation for use by the consumer. . .

"Research relating to the design, development and more efficient and satisfactory use of farm buildings, farm homes, farm machinery, including the application of electricity and other forms of power. . .

"Research relating to any other laws and principles that may contribute to the establishment and maintenance of a permanent and effective agricultural industry, including such investigations as have for their purpose the development and improvement of the rural home and rural life, and the maximum contribution by agriculture to the welfare of the consumer and the maintenance of maximum employment and national prosperity; and such

"Other researches or experiments bearing on the agricultural industry or on rural homes of the United States as may in each case be deemed advisable."

Although the term "home economics" does not appear in legislation pertaining to research, home economics has been associated with agriculture in laws relating both to the Cooperative Extension Service and to vocational education. The success of both of these teaching programs depends on a strong research base. Furthermore, the Department's research has always been closely associated with related programs of the Land-Grant Colleges and Universities--among which are nutrition and other phases of home economics.

Program Determination

The scope and character of research undertaken by the Department at any given time cannot be determined entirely on the basis of broad function or authorization. Among other considerations are the broad purposes for which funds are annually appropriated by Congress, the amount provided, ability to recruit qualified personnel and availability of needed research equipment and facilities. It is also necessary to exercise administrative judgment to insure that, within the broad purposes for which funds are provided, the specific problems selected for study are those which are of highest importance to the Nation; which are consistent with the responsibility and program of the Federal government and Department, and which are likely to have the kind of public support that is reflected in favorable Congressional attitudes and actions.

The budget process for justifying continuance of basic funds and consideration of program expansion consists of a number of steps:

1. Preliminary evaluation by the research staff of current program and its direction of view of new problems needing attention, and the development of proposals for new or redirected research.
2. Review by research advisory committees of current program and proposals made by staff for new work, discussion of emerging problems requiring research, and recommendations for future program.
3. Evaluation by the research staff of the relative usefulness of probable results of research on alternative problems, considering availability of base or increased funds and of research personnel, facilities and methodology, and recommendations for budget.
4. Policy review of recommendations by (1) several different administrative groups within the Department and, as modified, by (2) the President's Bureau of the Budget. On the basis of such review the President determines the budget to be submitted to the Congress.
5. Hearings on the agricultural section of the President's budget are held by a Subcommittee of the House Committee on Appropriations after which a report and bill goes to the House of Representatives. After the House has acted, the bill is considered by a Senate Committee (with hearings) and then is sent to the Senate for action. Any differences between the House and Senate bills must be resolved before final action by both Houses and Presidential signature.

The use to which both basic and new funds are put are thus determined in broad outlines by a thorough and time-consuming process. Any major change proposed in their use must have approval by Department policy-makers and by the Congress.

Program Implementation

Funds made available for home economics research have been small in relation to the broad scope of the subject matter. Hence, it has been necessary to select for research only those problem areas that seemed to be most in need of study and most appropriate for study by the Department, and for which staff could be recruited with the competence and in the numbers needed to give assurance of fruitful effort. The subject matter areas in which the Department of Agriculture has undertaken research follow:

Food and nutrition

1. Composition and nutritive value of food
2. Human requirements and nutritional response to diet
3. Food quality and household food processing
4. School feeding

Textiles and clothing

5. Fabric quality
6. Design, construction and care of clothing and household textile furnishings

Housing and household equipment

7. Requirements for functional farm housing
8. Performance requirements, use, and care of household equipment

Family economics

9. Household food consumption and dietary levels
10. Family expenditures and home management

Briefly described in the following sections of this report are the purpose, nature, and background of the program in each of these areas, a description of work now under way, examples of accomplishment, and staff proposals for new or expanded research.

I. COMPOSITION AND NUTRITIVE VALUE OF FOOD

A. Purpose and Nature of Work

The general purpose of this research is to determine the nature and quantities of nutrients and related substances in foods as marketed and as prepared for eating, and to develop and issue official tables of food composition for use in appraising diets and developing food plans.

Samples of raw and processed foods selected for variety, season and other variables and in relation to their importance in the food supply, are assayed as needed for energy value and for content of vitamins, proteins, amino acids, fats, fatty acids, carbohydrates, minerals and other constituents. Chemical, physico-chemical or microbiological methods for determination of these food constituents are developed as needed, and compared with biological values, using laboratory animals. Clarification of causes for differences between chemical and appropriate biological measurements are sought through investigations of factors which influence physiological availability, such as characteristics of the nutrients and the influence of interfering substances. Results are published in technical and popular form. Data from laboratory analyses and from the scientific literature are compiled and integrated to develop tables of food composition suitable for estimating the nutritive value of diets.

B. Current Program

Amino Acids - Work is under way on the amino acid content of typical foods. Preliminary tables are almost complete for 12 amino acids in about 100 common foods. These tables are urgently needed by the Department, nutritionists, and other groups concerned with the protein quality of food supplies, including the National Research Council's Committee on Amino Acids. As soon as available, the data will be used to estimate the amino acid content of the per capita food supply of this country and of the diets of selected households and individuals which are of doubtful protein quality. Meantime, laboratory studies are continuing on methods of assay for 8 other amino acids on which data on the distribution in foods are needed.

Fatty Acids - Data on the fatty acid content of foods are being assembled from laboratory analyses under contract and from published literature, and reference tables are being prepared for use in estimating the fatty acid content of food supplies and diets. These data are urgently needed in view of the current keen interest in the place of fat in human nutrition, and the need for defining desirable limits in quantity and kinds of fat in diets.

Minerals - Laboratory work has just been begun to determine the quantities of important minerals in today's foods as produced and processed for market. Available data on well-known minerals such as calcium, phosphorus and magnesium, refer largely to foods as produced some 40 years ago, few of which were processed in any form. In the meantime, nutrition research has aroused interest in and demand for more adequate data on these and other mineral elements, including sodium, potassium, cobalt, copper, manganese, molybdenum and selenium.

B-vitamins - Laboratory analyses of foods have just been started to determine quantities of pyridoxine (B₆) and cyanocobalamin (vitamin B₁₂) two B-vitamins which have challenged nutrition interest in the last three years. Analyses have just been completed and a publication providing tables of food values for pantothenic acid in foods is being prepared. Folic acid is another of the newly-recognized B-vitamins on which laboratory analyses have been completed recently and tables published showing its distribution and content in foods.

Data on edible yields as affected by variety, quality, and preparation methods were compiled from many studies including about 1,000 food items in different forms. Results which reflect present-day production and marketing have been integrated and will serve as useful reference in revising tables of food composition and nutritive value for diet appraisal and provide guidance to buyers in estimating quantities to be purchased for household and institutional use.

C. Publications

The following publications supplement those listed on pages 14-26 of "Publications on Human Nutrition and Home Economics, 1924-54."

Boneless beef: raw, cooked, served--results of analysis for moisture, protein, fat, and ash. E. W. Toepfer, C. S. Pritchett, and E. M. Hewston. (Submitted for publication as Tech. Bul.)

A reliable microbiological method for cystine. M. J. Horn and A. E. Blum. (To Cereal Chem. for publication)

Fatty acid composition and oxidative deterioration during storage of fats in cuts of beef, lamb, pork, and turkey. O. S. Privett, F. J. Pusch, and W. O. Lundberg. (To Food Tech. for publication)

Reduced ascorbic acid values of thirty-four foods. K. H. Fisher and M. L. Dodds. Food Res., Apr.-May issue. (Contract with Pa. St. Univ.)

D. Examples of Accomplishment

First Data on Food Composition - A wide variety of American foods were analysed for water, protein, fat, carbohydrate and ash content. For half a century figures from tables, published first in 1896 and revised and expanded in 1906, were widely used in textbooks of nutrition. Later analytical work broadened the base of these early values and added greatly to the number of foods and the number of nutrients which could be included in the tables. Over the years the tables of food composition have been expanded from data on a few nutrients, five constituents at first, to eight, to eleven, and then to fifteen nutrients, and from a list of about 100 foods, to more than 700.

Current Tables on Food Composition - A handbook which summarizes data on 750 foods -- in terms of water, food energy, protein, fat, total carbohydrate, fiber, ash, three minerals and five vitamins -- was issued in 1950. Titled "Composition of foods -- raw, processed, prepared," this bulletin replaced a succession of earlier Department publications outdated by new scientific work. It became the standard reference on composition and nutritive value of food for dietitians, teachers, nutritionists, and for those in medical practice who guide food selection and appraise diets. The data are also used in estimating the nutritive value of available food supplies and the relative economy and nutritive value of various food products -- an important task in effective food management. A special edition including 12 components of military rations was prepared for use of the Armed Forces in 1951.

Protein investigations have given an improved basis for food selection by individuals and households and for administrative decisions in food production and distribution. Among practical guides and principles developed were: (1) specific factors for converting quantities of nitrogen into protein values; (2) comparative values of the protein quality of major grains and oilseeds, of certain combinations of plant proteins, and of combinations of animal and plant proteins; (3) measurements of the effect on the quality of grain proteins of the storage of grains under different time, temperature, and container conditions -- a practical problem in the storage of surpluses; and (4) effect of heat processing on the protein quality of oilseeds and other foods. Other fundamental accomplishments were the isolation of a new amino acid (lanthionine), one form of which can replace in part the essential amino acid methionine, and the development of suitable methods for measuring the amino acid content of proteins and foods.

Data on distribution of newly-recognized nutrients were obtained through development and standardization of analytical methods and systematic assay of typical foods. For data on two newly-recognized B-vitamins, folic acid values were reported in 1951 and analyses for pantothenic acid completed in 1954. Stemming from laboratory analyses

started much earlier, values for 12 amino acids and for 5 fatty acids have been obtained and two reference tables in preparation will constitute the first tables for these nutrients that are now receiving increased dietary emphasis.

The calcium content of present-day bread was determined in over 400 samples of commercial white bread from 41 states and the District of Columbia in order to provide more up-to-date values for food composition tables. Although modern mold inhibitors and dough conditioners as well as dry milk may add considerable amounts of calcium to bread, the content differs so much throughout the country that bread must be regarded as a variable source of this nutrient.

E. Proposals for Committee Consideration: (I. COMPOSITION AND NUTRITIVE VALUE OF FOODS)

1. Proposals suggested by Department scientists:

- a. Carbohydrates in Foods - Initiate laboratory analyses on carbohydrates in foods to replace incomplete or obsolete data that are likely to give erroneous results in diet planning and appraisal. Data are needed on the content of fiber, starch, and other carbohydrates in foods as marketed and eaten today, in order to derive better values on the caloric values of foods. Because of lack of suitable methods, present carbohydrate values have been obtained not by direct assay but by residual difference from proximate composition data. Inadequate methods for carbohydrate as well as for fat analyses have resulted in values which can lead to as much as 20 percent error in the calculated caloric content of diets. This research is of special significance to those concerned with diabetes and weight control as well as with the development of a sound basis for appraising the place of different foods in the diet, for agriculture planning and for educational programs for consumers.
- b. Nutrients in New Foods - Expand analyses of nutrients in foods to obtain data on new foods and new forms of common foods which are not now included in tables of food composition. Commercial processing and modern marketing methods are responsible for many new items in food supplies and diets about which nutritive value information is nonexistent. Some are high-calorie, fat-processed, ready-to-eat foods including chips, snacks, sticks and other menu items from vegetables, nuts, grain products, meats and poultry. Others are formulated mixes for home cooking which are quite unlike household recipes in kinds and proportions of ingredients.

- c. Organic Acids in Foods - Initiate laboratory analyses to determine the kinds and quantities of organic acids in fruits and vegetables which affect other nutritive values. Present tables of food composition treat all organic acids as carbohydrates in reckoning calorie values, but some are not metabolized for energy production by human beings while others are poorly utilized by some individuals, and some affect the utilization of calcium and other nutrients. Data on the distribution and content of predominating organic acids in foods are needed to improve the accuracy of values for calories and other nutrients and also would provide the medical profession with basic information needed in prescribing diets for some metabolic disorders.
- d. Variation in Vitamin Content of Foods - Initiate analyses of available data on variation in vitamin content of foods to derive figures appropriate for variety, place of production, and degree of maturity, as well as for types of commercial and household processing. The analyses would show also wherein available data are meager for common varieties and conditions, and where additional laboratory analyses are most needed. This research calls for developing the design of the analyses, converting masses of data to uniform systems of expression and transfer to machine punch cards to facilitate analyses and preparing practical tables of vitamin values.

2. Proposals suggested by members of Committee:
(To be developed prior to or at the Committee meeting.)

II. HUMAN REQUIREMENTS AND NUTRITIONAL RESPONSE TO DIET

A. Purpose and Nature of Work

The general purpose of this work is to determine the food energy and the kinds and quantities of nutrients needed by individuals in different circumstances of age, activity and environment; to investigate functions and interrelationships of nutrients as they affect requirements; to determine the physiological availability of nutrients from various food sources; and to study the body's response to various food combinations, including diet in relation to nutritional status.

Nutritional requirements of individuals and the response of human subjects both to self-selected diets and to quantitatively controlled intakes of foods, energy value, and nutrients are being studied using anthropometric, physiological, biochemical, and in cooperation with health and medical groups, clinical measures. Similar methods are used to investigate functions and interrelationships of nutrients and availability of nutrients from foods. Studies with human subjects are supplemented by research using experimental animals in order to provide data on the effect of diet over the entire life span and on successive generations. In addition, studies with experimental animals on different amounts, kinds, and combinations of foods and nutrients are made to delineate problems and to obtain data that may be qualitatively applicable to human beings. Results are published in technical and popular form.

B. Current Program

Nutritional requirements of children and adults of different age groups and the metabolic response of human subjects to self-selected and controlled intakes of foods and nutrients are being studied using various biochemical and other criteria. A number of cooperative studies on nutritional status of children and older persons on self-selected diets are nearing completion and results are being reported in a variety of publications. In progress are studies of digestibility of protein and availability of amino acids from foods in human diets, and of the effect of type of carbohydrate in the diet on the physiological utilization of amino acids, in laboratory animals. Research is also under way on long-term effects of different foods and dietary combinations on physiological efficiency and premature physical impairment in adult laboratory animals.

Amino Acid Requirements - Coordinated studies at three institutions (Universities of California, Nebraska and Wisconsin, under contract) are providing the first metabolic data indicating the amino acid requirements of women. Determinations have been made on 8 amino acids - isoleucine, leucine, lysine, methioine, phenylalanine, threonine, tryptophane and valine - and reports are being prepared for publication. Such data have long been needed for appraising the protein quality of foods and diets, and for planning better diets in times of abundance as well as scarcity.

Fatty Acid Requirements - From a series of studies with the University of Texas Medical Branch (under contract), a better understanding of human requirements for unsaturated fatty acids is emerging. The most important of these in foods is linoleic acid. The quantity of linoleic acid in blood serum was found to be higher in well-nourished children than in children with poor fat absorption, higher in young children than in infants, and higher in infants on human milk than on cow's milk. Human milk is higher in linoleic acid than is cow's milk and the difference is reflected in lowered blood levels in a relatively short time after infants are shifted from human to cow's milk formula.

Diet and Serum Cholesterol in Men - Findings from two cooperative studies, Universities of California and Minnesota, of food intake in relation to nutritional status of men 50 to 80 years of age throw light on the relation of dietary fat to blood cholesterol in aging men. Blood cholesterol (often associated with hardening of arteries) was highest in the decade of 50 to 60 years, lower after 70 years; higher in retired men living in their own homes than in men in a county home; but lower in the retired men (California) than in active business men living in another part of the country (Minnesota). Some reports of this research have been published, others are in preparation.

Diets of Individuals - Substantial progress has been made in the publication of results of cooperative studies with the North Central and Western Regions of food intake and nutritional status. During the past year, 13 papers relating to children and 13 to older persons have been published in scientific journals and bulletins, and others are ready for publication. From the various surveys the dietary findings, often backed up by corresponding biochemical values, show that diets contain less than desirable amounts of calcium, vitamins A and C, and in some places, less thiamine. Diets of teen-age girls tend to be lower in most nutrients than those of boys, adolescents relatively lower than younger children. Facts such as these help to guide food distribution and educational programs for improving human nutrition.

Energy Expenditures in Women - Studies were recently begun (under contract) of the energy expenditures of women of different ages performing the same household tasks, to provide basic data on energy expenditures and metabolism in older women as well as to accumulate figures on the energy cost of common tasks which add up to the day's total caloric needs. Dietary studies of women elsewhere show surprisingly low caloric intakes, yet the prevalence of obesity among women is a cause for medical concern. Many data on energy expenditures in present-day household activities are needed for improving estimates of caloric requirements at different ages.

Energy Expenditures in Children - Data on the energy expenditures of pre-adolescent boys and girls at common activities, derived in a series of studies cooperative with Teacher's College, Columbia University, are now being evaluated and integrated for publication. In addition to the quantitative information on energy output of young children in different situations, these data provide bases for better estimates of the caloric and food needs of children. (See examples of accomplishments)

Development of a Reference Diet for Human Nutrition Research - An experimental diet which supplies essential nutrients at moderate reference levels has been developed and used for several weeks in studies of metabolic response of young women to the diet. The diet is so constructed, partly of natural foods, partly of semi-purified foods, and partly from chemically pure sources, that the intake levels of any one nutrient can be adjusted upward or downward over wide range, or one natural food can be replaced by another of the same type. Such a standardized reference diet with uniform analytical procedures provides a needed research tool for studies of human requirements and physiological availability of nutrients from foods. It will make possible interlaboratory comparisons of data on human subjects, thereby enhancing the value of data from any one laboratory and advancing the understanding of human metabolism and nutrition. A publication giving details of the methods is in press and will be used as a manual in arranging contract work at other locations.

C. Publications

The following publications supplement those listed on pages 3-13 of "Publications on Human Nutrition and Home Economics Research, 1924-54."

Nutritional Requirements

Amino acid requirement of young women. IV. Phenylalanine. (Abstract) R. M. Leverton, M. Johnson, J. Ellison, M. Skellenger, D. Gerschwender, and F. Schmidt. Fed. Proc. 14(1, pt. 1): 1425. Mar. 1955. (Contract with Nebr. Exp. Sta.)

Methionine and lysine requirements of mature women. (Abstract) E. M. Jones, C. A. Baumann, and M. S. Reynolds. Fed. Proc. 14(1, pt. 1): 1417. Mar. 1955. (Contract with Univ. Wisc.)

Estimation of thiamine allowances for adolescent boys. (Abstract) J. M. Smith, S. Chen, M. J. Bert, and E. Dick. Fed. Proc. 14(1, pt. 1): 1457. Mar. 1955. (Contract with Univ. Ill.)

A standarized diet for metabolic studies--its development and application. F. L. Meyer, M. L. Brown, H. J. Wright, and M. L. Hathaway. Tech. Bul. 1126. (In press)

Influence of fat in the diet on distribution of unsaturated fatty acids in the serum of dogs. (Abstract) H. F. Wiese, M. A. Baughan, and A. E. Hansen. Fed. Proc. 14(1, pt. 1): Mar. 1955. (Contract with Univ. Tex., Med. Br.)

Effect of dietary fat on unsaturated fatty acids of serum of infants. (Abstract) A. E. Hansen, H. F. Wiese, M. Lawliss, D. J. D. Adam, and M. A. Baughan. Fed. Proc. 14(1, pt. 1): 1409. Mar. 1955. (Contract with Univ. Tex., Med. Br.)

Alteration of rats' serum protein produced by diet. (Abstract) E. Callisch and M. Fisher. Fed. Proc. 14(1, pt. 1): 1385. Mar. 1955.

Parenteral administration of vitamin B₁₂ into day old chicks. (Abstract) F. A. Csonka. Fed. Proc. 14(1, pt. 1): 642. Mar. 1955.

Variability in the measure of total ascorbic acid utilization by the human. K. H. Fisher and M. L. Dodds. Jour. Nutr. 54(3): 389. Nov. 1954. (Contract with Pa. St. Univ.)

Nutritional status of school children (before and after starting to school) (Abstract) N. P. Dillard, E. B. Jones, N. M. Tanner, and V. R. Goddard. Pub. Health Rept. 175. Feb. 1955.

Starches, sugars, and related factors affecting liver fat and nitrogen balances in adult rats fed low levels of amino acids. M. Womack and M. W. Marshall. To Jour. Nutr. for publication.

Food and Nutritional Status - Children

Nutritive value of the diets of Iowa school children. E. S. Eppright, V. D. Sidwell, and P. P. Swanson. Jour. Nutr. 54(3): 371-388. Nov. 1954. (Coop. No. Cent. Region. Proj.)

Physical measurements of Iowa school children. E. S. Eppright and V. D. Sidwell. Jour. Nutr. 54(4): 543-556. Dec. 1954. (Coop. No. Cent. Region. Proj.)

Relationship of estimated nutrient intakes of Iowa school children to physical and biochemical measurements. E. S. Eppright, C. Roderuck, V. D. Sidwell, and P. P. Swanson. Jour. Nutr. 54(4): 557-570. Dec. 1954. (Coop. No. Cent. Region. Proj.)

Distribution of calories in diets of Iowa school children. E. S. Eppright and P. P. Swanson. Amer. Dietet. Assoc. Jour. 31(2): 144-148. Feb. 1955. (Coop. No. Cent. Region. Proj.)

Diet and nutritional status of Iowa school children. E. S. Eppright and C. Roderuck. Amer. Jour. Public Health 45: 464-471. 1955. (Coop. No. Cent. Region. Proj.)

Distribution of nutrients among meals and snacks of Iowa school children. E. S. Eppright and P. P. Swanson. Amer. Dietet. Assoc. Jour. 31(3): 256-260. Mar. 1955.

Dental caries prevalence in children 15 and 16 years of age in three Idaho communities. K. O. Porter and E. Woods. Jour. Dental Res. 33(4): 542-551. Aug. 1954. (Coop. West. Region. Proj.)

The nutritional status of Papago Indian children. M. G. Vavich, A. R. Kemmerer, and J. S. Hirsch. Jour. Nutr. 54(1): 121-132. Sept. 1954. (Coop. West. Region. Proj.)

Children with and without rheumatic fever. III. Blood serum vitamins and phosphatase data. E. B. Wilcox, L. S. Galloway, P. Wood, and F. L. Mangelson. Jour. Amer. Dietet. Assoc. 30(12): 1231-1238. Dec. 1954. (Coop. West. Region. Proj.)

Children with and without rheumatic fever. IV. Hemoglobin, packed red cells, red and white cell count, sedimentation rate, blood glucose, serum iron, and copper. E. B. Wilcox, F. L. Mangelson, L. S. Galloway, and P. Wood. Amer. Dietet. Assoc. Jour. 31(1): 45-51. Jan. 1955. (Coop. West. Region. Proj.)

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Blood Values of Women: Cholesterol. P. Swanson, R. Leverton, M. R. Gram, and others. Jour. of Gerontology 10: 41-47. 1955. (Coop. No. Cent. Region. Proj.)

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Nutritional status of the aging. IV. Serum cholesterol and diet. H. L. Gillum, A. F. Morgan, and D. W. Jerome. Jour. Nutr. 55(3): 449-468. Mar. 1955. (Coop. West. Region. Proj.)

Nutritional status of the aging. V. Vitamin A and carotene. H. L. Gillum, A. F. Morgan, and F. Sailor. Jour. Nutr. 55(4): 655-670. Apr. 1955. (Coop. West. Region. Proj.)

Nutritional status of the aging. VI. Serum protein; blood non-protein nitrogen, uric acid, and creatinine. A. F. Morgan, M. Murrai, and H. L. Gillum. Jour. Nutr. 55(4): 671-685. Apr. 1955. (Coop. West. Region. Proj.)

D. Examples of Accomplishment

Construction of the Atwater-Rosa-Benedict respiration calorimeter marked the beginning of many studies by numerous investigators of the energy expenditure of persons both in health and disease. Atwater's studies also provided fundamental information which led to the development of simplified apparatus and procedures for estimating energy requirements of people.

Digestibility and physiological energy value of foods, determined in investigations with human subjects at the turn of the century, provided a basis for the much-used 4-9-4 calorie values for protein, fat, and carbohydrate which were derived for calculating the caloric content of diets typical of that period.

Vitamin A requirements of young adults was determined in the 1930's by a study of the quantities of this nutrient required to restore and maintain normal night vision in subjects who had lost it as the result of an experimental diet extremely deficient in vitamin A. This research was the first to show that it is possible to obtain such quantitative data for vitamin requirements with human subjects. The research stimulated experimental work of a similar nature in this and other countries and helped give a scientific basis for the daily allowance of vitamin A recommended by the Food and Nutrition Board of the National Research Council. The results were also used in setting up Food and Drug standards for labeling vitamin preparations and food products as sources of vitamin A.

Vitamin A availability to both animals and humans was found to be greater than that of pure carotene. Also, the carotene from yellow vegetables such as carrots, sweetpotatoes, and pumpkin was shown to be markedly less available than that from leafy green ones such as kale or that in yellow corn or that of carotene in oil. These facts have important implications for agriculture and nutrition, inasmuch as two-thirds of the apparent vitamin A value of diets in the United States is derived from foods of plant origin. During these studies the instability of the then accepted United States Pharmacopoeia reference standard for vitamin A was demonstrated, with the result that a new standard was established by the Committee on the Pharmacopoeia.

Ascorbic acid requirements of adolescents have been made more definite through controlled feeding experiments that related diet to levels of this vitamin in the blood of about 100 girls and boys, 12 to 19 years of age.

The distribution of nutrients among the day's meals has been found to affect their value to the individual. In a study of 8 types of breakfasts it was learned that when at least one-third of the daily protein allowance was eaten at breakfast, the blood sugar was kept at a desirable, more uniform level than when a meal with less protein was ingested. When the noon meal was meager, breakfast influenced blood sugar levels throughout the day.

Vitamin E deficiency and eye damage was observed in the course of research with rats fed diets short in vitamin E. Some of the young were found to develop eye abnormalities of a kind not previously observed in these laboratory animals. This finding proved useful to those investigating the nature, cause, and prevention in premature infants of the disorder known as retrolental fibroplasia.

Response to various food combinations has been examined by feeding selected experimental diets to laboratory rats not only over their entire life span but also through successive generations. It was observed that combinations of food that seem to provide adequately for growth may tend to accentuate certain chronic ailments commonly associated with age. An abnormal lipo-protein substance found in the blood of these animals may account for the kidney and cardiovascular damage.

Research on energy expenditures of children at common activities, providing data not previously available, were used by the National Research Council as a basis for revising the 1954 allowances of food energy for boys and girls of school age.

A survey of nutritional status of persons on self-selected diets was made early in the 1930's and was concerned with the food supply and pellagra incidence among 73 South Carolina families. Since the Research and Marketing Act of 1946, surveys of individual diets and nutritional status have been possible in cooperation with groups of experiment stations in the North Central and Western Regions, with particular attention to children, adolescents and older persons. The results provide new guides to needed emphasis in nutrition education programs.

Survey of Food and Nutrition Research - To aid research leaders in universities, industry and government to prevent duplication of effort and to make best use of funds, a survey of nutrition research in this country was made (under contract) in 1952-53. The published report recorded research under way by some 440 organizations and included research in physiological and biochemical aspects of nutrition, nutrition in disease, nutritive value of food and feed, and nutritional requirements of man and beast. Among some 250 suggestions for needed research of immediate urgency, were more than 35 in food composition and more than 100 relating specifically to human nutrition.

E. Proposals for Committee Consideration (II. HUMAN REQUIREMENTS AND NUTRITIONAL RESPONSE TO DIET)

1. Proposals suggested by Department scientists

- a. Physiological Availability of Nutrients from Foods - Expand research to determine the physiological availability of nutrients from foods, and the extent to which food processing, food composition and diet patterns affect availability. Particular attention should be given to the physiological availability of amino acids from foods and diets including foods processed according to present day practices. This work calls for digestibility and metabolic studies using human subjects, to supplement other methods for determining the extent to which nutrients are available from typical foods as commonly eaten. This information is especially needed for planning and for appraising the nutritional value of various diets.
- b. Fat in Human Nutrition - Initiate research to investigate the role of fat in human nutrition, such as the relationship of the amount and kinds of fat to metabolism of other nutrients, determination of desirable upper and lower limits of fat intake in various nutritional situations, and the dietary precautions needed when fat in diets is unusually high or low.

This research is urgent in view of the growing evidence of the relation of diet to the development of renal - cardiovascular disease. Studies of aging persons and of laboratory animals on abundant diets have implicated high-fat, high-calorie diets in some disorders of metabolism. A war-time recommended level of fat in diet was 25 percent of the calories from fat; countries under economic stress often have levels below 20 percent; present level in USA averages about 40 percent, with well over 50 percent of the calories from fat in some individual diets.

- c. Diet and Aging in Healthy Adults - Initiate research on the nutritional response to diet over a period of years by adult men and women considered to be in excellent health. This research should include individuals in each decade from 20 to 70 years, with periodic appraisal of diet and of physical and nutritional status using appropriate biochemical, physical and other criteria, to discover trends in food consumption and physiologic utilization of nutrients, and trends in various biochemical, physiologic and metabolic criteria which change with age, and if possible the relation of these changes to diet, environment and health history.
- d. Long-term Effects of Dietary Combinations - Expand research on the effect of diet on adult efficiency and premature physical impairment in laboratory animals to include more intensive observations of the nature, extent, and probable nutritional significance of the impairment. This research should provide for more histological and gross anatomical records of changes in the animal at all ages, more chemical and physical analyses of blood and other tissues with particular attention to abnormal protein-fat fractions, and some enzyme analyses of vital organs and tissues.
- e. Dietary Factors Affecting Amino Acid Requirements - Expand research on the effect of type of carbohydrate in the diet on amino acid utilization to include other components of diet, and other biochemical and physical criteria of the nutritional effects. Attention should be given to "non-essential" amino acids and non-protein nitrogen, as well as "essential" amino acid ratios in the diet. The criteria should include, in addition to studies of nitrogen balance and calorie utilization, analysis of blood and other tissues by histological, chemical and physical (body composition) means. This is basic information needed for determining amino acid requirements of people consuming diets of different patterns.

2. Proposals suggested by committee members

(To be developed prior to and at the committee meeting)

III. FOOD QUALITY, PREPARATION AND PRESERVATION

A. Purpose and Nature of Work

The general purpose of this work is to evaluate cooking and eating quality of foods as affected by production, processing and marketing practices; to determine the household utility of various qualities of commodities; to study the effect of household processing, storage and care on eating quality; and to develop efficient, suitable and safe methods for food preparation and preservation.

Physical characteristics, chemical properties, histological structure, and the microbiological conditions of foods are studied in relation to the wholesomeness, palatability, yield, and nutritive value of the prepared product. Cooking qualities and palatability, and factors affecting them, are determined for established as well as for new and experimental varieties and forms of food -- studies usually cooperative with production and marketing research agencies. Data on cooking time and method, yield and edible quality of foods are accumulated and insofar as feasible related to factors of composition and market grade. Practical directions are developed for the preparation, preservation, and storage of fresh and processed foods, and suggestions for food use published to promote expanded, more varied, or more satisfactory use of food supplies by families and institutional users. Results are reported in both technical and popular form.

B. Current Program

Attention is being given to the utility of different qualities of several major commodities -- apples, beef, eggs, potatoes, and poultry. Other studies are concerned with effect of field use of agricultural chemicals such as pesticides and hormones, on flavor of vegetables, and with yields of fruits, vegetables and poultry from food as purchased.

Fruits - Contributing to effective utilization of fresh apples are studies almost completed to determine changes in chemical composition, palatability, and cooking quality of orchard samples of six varieties of apples, during controlled storage up to 7 months. Changes found in suitability for eating out of hand, for sauce, or for baked apples will be translated into practical recommendations for improved use of common varieties as marketed.

Potatoes - French frying quality of potatoes, of interest to household and restaurant users, is being related to variety-location-crop year and storage factors. (This is an extension of studies of quality for other cooking purposes. See examples of accomplishments). For example, results indicate that potatoes may be partially fried (commercially or in the household) when at the peak of frying quality and held in frozen storage until ready for use. Also, if finished off in a hot oven, an excellent product about 15 percent lower in fat content is obtained than if final cooking is in deep fat. A technical report of this work is in press.

Rice - Reference methods for determining cooking qualities of rice for specific purposes are being developed and standarized for uniform use by other laboratories and field stations. This is being done at the request of several agencies concerned with breeding and production and with foreign and domestic marketing of different varieties of rice, to give maximum consumer satisfaction. Methods for cooking and using rices of different qualities involve the food habits and cooking facilities peculiar to different regions of this country and differences even more marked in other countries.

Beef - The suitability of various methods of cooking has been investigated with reference to grass-fed, cow and other beef of low grades produced in different areas of the country, under contract and cooperative arrangements with universities and experiment stations in seven locations. Basic information on improved use of these economical types of beef is needed for improvement of diets of low income families who cannot afford expensive grades, as well as for improvement of all diets which tend to run high in proportions of fat. A number of publications have been issued and a consolidated report is in preparation.

Eggs - Under contracts with three institutions, the cooking quality of eggs produced in different regional locations and on different common rations, were evaluated before and after storage to determine limitations in use for specific purposes. Findings are being published in a number of technical articles (see list of recent publications). Significant results are being integrated into a chart-book form of presentation for use by teacher-leader groups of home economists, producers and marketing research workers.

Food Safety - Studies are being completed which determine for various types of food preparation especially those containing eggs, whether the heat applied during cooking is adequate to destroy *Salmonella* bacteria when such organisms are present in ingredients. These investigations are primarily concerned with the problem of safe use of dried eggs, and the findings have served as the basis of a manuscript for a revised Departmental publication on cooking with dried eggs.

Food Flavor Affected by Pesticides - Continuing studies cooperative with other research agencies are under way on evaluation of palatability of foods, particularly vegetables, as affected by exposure to agricultural chemicals such as pesticides during production, processing or marketing. Potatoes, carrots, turnips and green beans are among the vegetables recently studied that were commonly affected by some insecticides. Residues of benzene hexachloride and lindane, accumulated in the soil, may cause off-flavors the following year in crops which have never received direct applications.

Food Preservation - Improved formulas with emphasis on rapid, time-saving procedures are being developed for home conservation of seasonal surpluses of fruits as jellies, jams and preserves. For example, a fresh flavored strawberry jam using berries frozen during the previous season may be made without cooking but must be held under refrigeration.

C. Publications

The following publications supplement those listed on pages 45-65 of "Publications on Human Nutrition and Home Economics, 1924-54."

Cooking Quality - Eggs, Potatoes, Poultry, Meat

Research findings on cooking quality and flavor of shell eggs. E. H. Dawson, C. Miller, and R. Redstrom. (Contract with La. Exp. Sta. Purdue Exp. Sta., Wash. Exp. Sta.) Submitted for publications as Agr. Inf. Bul.

The flavor of your eggs--how good is it. B. A. McLaren and W. J. Stadelman. Poultry Proc. and Marketing 61 (2); 20-21, 34, 36. Feb. 1955. (Contract with Wash. Exp. Sta.)

Shell eggs - quality and properties as affected by temperature and length of storage. R. Jordan, A. T. Barr, and M. L. Wilson. Purdue Exp. Sta. Bul 612. Oct. 1954. (Contract with Purdue Exp. Sta.)

A comparison of several methods for evaluation of quality in eggs. J. V. Harns, E. A. Sauter, B. A. McLaren, and W. J. Stadelman. Poul. Sci. 33: 1022-1028. Sept. 1954. (Contract with Wash. Exp. Sta.)

Some factors affecting flavor of eggs. J. V. Harns, E. A. Sauter, B. A. McLaren, W. J. Stadelman. Poul. Sci. 33: 992-997. Sept. 1954. (Contract with Wash. Exp. Sta.)

Relationship among physical, functional, and flavor properties of eggs. B. A. McLaren and W. J. Stadelman. Wash. Exp. Sta. Tech. Bul. 14, Sept. 1954. (Contract with Wash. Exp. Sta.)

French frying quality of potatoes as influenced by cooking methods, storage conditions, and specific gravity of tubers. M. E. Kirkpatrick, P. H. Heinze, and B. M. Mountjoy. Tech. Bul. (In press.) (Coop. AMS.)

Cooking quality and compositional factors of potatoes of different varieties from several commercial locations. P. H. Heinze, M. E. Kirkpatrick, and E. F. Dochterman. Tech. Bul. 1106 March 1955. (Coop. AMS)

Effects of cooking methods on low grade beef. M. P. Hood, D. W. Thompson, and L. Mirone. Ga. Exp. Sta. Bul N. S. 4. Feb. 1955 (Contract with Univ. Ga.)

Effect of cold storage and method of cooking on commercial grade cow beef. P. Paul, M. Bean, and L. J. Bratzler. Mscpt. approved by HN for publication as Mich. Exp. Sta. Tech. Bul. (Contract with Mich. State Col.)

The effect of moist and dry heat cooking on vitamin retention in beef animals of different levels of fleshing. S. Cover and W. H. Smith, Jr. (Contract with Tex. Exp. Sta.) Mscpt. approved for publication by HN.

The effect of moist and dry heat cooking on palatability scores and shear force values of beef animals of different levels of fleshing. S. Cover, M. Shrode, and W. H. Smith, Jr. (Contract with Tex. Exp. Sta.) Mscpt. approved for publication by HN.

A study of three cuts of lower and higher grade beef, unfrozen and frozen, using two methods of thawing and two methods of braising: Cooking data, palatability, shear, press juice, color, moisture, fat, total nitrogen, thiamine and riboflavin content and retention. F. Fenton. Mscpt. approved by HN for publication as E. S. Memoir. (Contract with Cornell Univ.)

The effect of different methods of cooking beef round of commercial and prime grades. I. Palatability and shear values. R. M. Griswold. Food Res. 20 (2): 160-170. Mar.-April 1955. (Contract with Univ. Chicago.)

The effect of different methods of cooking beef round of commercial and prime grades. II. Collagen, fat, and nitrogen content. R. M. Griswold. Food Res. 20 (2): 171-179. Mar.-Apr. 1955. (Contract with Univ. Chicago.)

Effect of Agricultural Chemicals on Food Flavor

Flavor tests on potatoes grown in soil where lindane was applied to cucumbers. M. E. Kirkpatrick, G. S. Linton, B. M. Mountjoy, and L. C. Albright. (Coop. ENT.) To Potato Jour. for publication.

Flavor and benzene hexachloride content of peanuts grown in rotation with cotton dusted with insecticides containing benzene hexachloride. H. Reynolds, G. L. Gilpin, and I. Hornstein. Cir. 952, 26 pp. Dec. 1954. (Coop. with ENT.)

Benzene hexachloride content and flavor of peanuts grown in rotation with cotton dusted with this insecticide. I. Hornstein, H. Reynolds, G. L. Gilpin. Jour, Agr. and Food Chem. 2(15): 776-778. July 21, 1954. (Coop. ENT.)

Food Preparation

Money-saving main dishes. Home and Garden Bull. 43 Feb. 1955. (Rev. Leaflet 289.)

Dry beans, peas, lentils...modern cookery. M. T. Swickard. Leaflet 326 Slightly revised. Nov. 1954.

Turkey on the table the year round. M. T. Swickard (HN,ARS), S. J. Marsden (APH, ARS), and R. S. Mainland, (AMS). Home and Garden Bull. 45. Oct. 1954. (Rev. Farmers Bul. 2011).

D. Examples of Accomplishment

Meat and Poultry - Cooking time and shrinkage of beef and lamb were investigated in cooperation with Federal-State production research, and related quantitatively to market grade, aging, method of trimming, and temperature of cooking. Results were reported in the technical literature and applied in cooking directions and recipes for the use of homemakers.

Cooking and palatability studies of turkeys that had been fed fish products led to recommendations that menhaden, white fish, herring meal, and fish oils be omitted from rations fed turkeys from 8 weeks of age until marketing, and that sardine meal be limited to proportions specified for different types of diet.

Turkey parts (halves, quarters, steaks - marketed in fresh and frozen form) of the large type bird, commonly suited only to restaurant and hotel use, were studied to learn the cooking times and procedures which yield the most tender, moist, and palatable product. Results were incorporated in the bulletin, "Turkey on the table the year round," prepared jointly with the poultry production and marketing research workers.

Research on the cooking quality of mature hens (culls of flocks) showed that proper simmering or steaming could give palatable cooked chicken from hens of all three grades, A, B, C. Pressure cooking was less satisfactory. Cooked-carcass yields were highest for Grade C hens, but flavor and texture were lowest.

Dry milk - Directions were developed for home and institution use of dry milk solids in many dishes ordinarily made without milk. It was found that by adding dry milk, quantities of milk solids could be doubled in many dishes and beverages commonly made with fluid milk without affecting acceptability. These practices allow substantial increase of nutritive value without appreciable increase in the volume of foods or beverages.

Eggs - Fundamental studies were made in the 1930's of the leavening power and flavor of eggs as affected by storage and other factors. During World War II, facts were provided through cooperative research to help in developing specifications for storage conditions that would retain the original flavor and cooking quality of spray-dried whole eggs.

The storage life of dried eggs with a moisture content of 3 to 5 percent, for example, was found to be one year when the temperature was below 60° F., but deterioration was pronounced in a month at 86° F. The keeping quality of experimentally dried whole eggs was found to be improved with the addition of certain carbohydrates before spray drying. Use of egg shells to increase the calcium content of dried eggs was shown to be possible. The presence of shell could not be detected in experimentally produced egg powders containing 0.4 percent of shell finely ground to pass a U. S. No. 400 sieve, when used in scrambled eggs, ice cream, breads, and cakes.

Vegetables - Studies made in the 1920's on 70 fresh and 20 brined vegetables became the basis of directions for practical home cooking. The research also provided figures on discards in home preparation on 22 vegetables, on the yield of cooked food from one pound of each as purchased, and on fuel needed for cooking. These waste and yield figures were useful for calculating nutritive values of foods in making diet recommendations.

Wartime studies of the effect of various home cooking methods on the nutritive value of potatoes, carrots, peas, and a number of other foods, resulted in standardized methods of cooking which are an important addition to knowledge in this field.

Dry Beans and Peas - In the late 1920's and in the 1930's, directions were developed for cooking lentils, beans, soybeans, and peanuts. In recent research, a shorter method of preparing dry beans, using an improved short hot soak, was developed with provides cooked beans comparable in palatability and nutritive value to those prepared by the long soaking method previously recommended.

Potatoes - To guide buyers and users seeking potatoes for specific purposes -- baking, boiling, mashing and salads -- the cooking quality of six varieties of potatoes grown in different locations for 2 crop years was studied. Quality was found to differ not only by variety but also for the same variety in different locations and soil conditions or in different crop years, and under different duration and temperature of storage of the tubers. Cooking quality for the purposes tested was related to specific gravity and total dry matter. These basic findings indicate to producers and handlers some of the conditions which must be controlled in order to market potatoes with the qualities wanted by consumers.

Recipe Development - Aid to homemakers through recipe information has been given since the beginning of the Bureau of Home Economics. "Aunt Sammy's radio recipes," a bulletin first issued in 1927, was long a best seller among government publications. In the 1930's, fats for shortening and frying were compared. Other studies included recipes for adding rice polish, wheat germ, and nonfat milk solids to batters and doughs, soups, and cereal mixes, as well as recipes using rye flour, corn meal, and corn syrup.

Recipe leaflets on tomatoes, green vegetables, potatoes, soya flour and grits, dry beans, dried fruits, and other commodities were developed during World War II, to help promote better use of foods available. Later, in 1947, to meet problems of scarce food supplies, recipes for low-cost main dishes were developed. More than 6 million copies of the resulting publication were distributed.

At the request of the Congress, a handbook, "Family Fare," was issued in 1950 bringing together under one cover information on nutrition and food management, as well as some 200 family-sized tested recipes and 60 appropriate menus.

Following recommendations of the Department's commodity advisory committees and stimulated by the interest of the National Restaurant Association, the American Hospital Association, and college food-service managers, a service of quantity recipes using abundant foods was instituted in 1949. Recipes were developed for these foods in sizes to serve 25, 50, and 100, and through arrangements with the National Restaurant Association, the recipes were also tested by the Association's testing committees in 4 cities, and by a college food service department. As developed these quantity recipes were distributed to about 4,000 food service units until the work was discontinued in 1954.

Development of Improved Home Dehydration Procedures - In 1941, when equipment for home canning or freezing foods was in short supply, improved home drying methods were developed to help prevent waste of garden produce grown by some 18 million Victory Gardeners. Existing methods for drying foods were investigated independently and in cooperation with the California, New York, and Texas Agricultural Experiment Stations, and modified procedures for typical vegetables and fruits were developed to provide for better palatability, keeping quality, and nutritive value of home-dehydrated products. Resulting improved methods were published for distribution to families.

Development of Improved Home Canning Methods - During World War II, national food conservation programs led 25 million families to can an estimated total of 4 billion quarts of food a year. Spoilage was unduly high, however, chiefly because of inadequate home processing methods. To obtain information needed to put canning practices under home conditions with home equipment on a scientific basis, research was carried out independently and in cooperation with the Massachusetts and Texas Agricultural Experiment Stations and with the University of Texas. Findings were the basis for new directions for home canning of meat, chicken, 12 of the most common home-canned low-acid vegetables, and 7 other low-acid foods.

Additional bacteriological studies related to canning have provided further basic data on the heat resistance of organisms causing food spoilage and on the heat treatments required to destroy such organisms in the canning of specific food products.

Development of Improved Home Freezing Methods - To meet demands for information on preserving foods by freezing, a popular bulletin was published in 1946 providing detailed and tested procedures for freezing 23 fruits and vegetables. This was based on work initiated in 1944 to determine the effect of different methods of home freezing on the palatability, nutritive value, and storage quality of frozen vegetables and fruits. Continued investigations led to further improvement in methods for preparing and pre-treating fruits and vegetables for freezing.

To help evaluate completed and current research on freezing food, a conference was sponsored in 1949 of freezing specialists from institutions in various sections of the country. Based on the recommendations of this group and a critical review of hundreds of research papers and bulletins as well as many unpublished data and further research, a comprehensive bulletin containing directions for the preparation, packaging, and freezing of more than 100 fruit and vegetable products was issued. A new popular bulletin on home freezing of fruits and vegetables was released in 1951.

Special War-time Services - To meet needs for foods of high keeping quality and low bulk, it was necessary during World War II to evaluate the cooking quality and palatability of commercial and experimental dehydrated foods. Samples of dehydrated raw meat were tested (Lend-Lease project) and found after cooking to be more nearly like fresh meat in quality than precooked dehydrated meat. When vacuum-packed and stored at a temperature of 70° F. or lower, the dehydrated raw meat remained in good condition for 8 months. Attainment of a low-moisture content was an important factor in the keeping quality of dehydrated raw meat. Another cooperative research project showed that the volume of dehydrated vegetables and soups could be reduced and still leave the products easy to reconstitute, as well as palatable, pleasing in appearance, and suited for storage without refrigeration for a considerable length of time.

E. Proposals for Committee Consideration. (III. FOOD QUALITY, PREPARATION AND PRESERVATION)

1. Proposals suggested by Department scientists:

a. Improved Cooking Procedures for Commodities Presenting Special Problems - Expand basic research on the quality characteristics of certain types of meats, fruits and vegetables, which -- because of changes in production and marketing practices -- present new problems in cooking. For each group of commodities, the research would involve many diverse foods and would require: (a) analysis of physical and chemical constituents and characteristics of raw, cooked and home-processed products that determine the suitability

of different methods of cooking, and (b) development of home procedures best adapted to foods of the many market qualities and new varieties now available, to assist consumers in making better use of market offerings.

- b. Methods for Evaluating Palatability - Initiate research to develop and standardize more rapid, reliable and reproducible laboratory methods, and procedures for the sensory evaluation of food quality. The basic physiological, psychological, biochemical, and electro-chemical reactions involved in sensory methods of evaluating food should be investigated, parallel with measures of physical, chemical and histological attributes of foods, and palatability evaluations of color, flavor and texture. The problem of measuring palatability is one of great concern to many groups, including producers, manufacturers of pesticides, food processors and food service managers as well as to consumers themselves.
- c. Problems in Freezing "Home-prepared" Foods - Initiate research to develop improved methods and formulae for frozen home-prepared foods and to facilitate efficiency in the management of food supplies, time and labor. The procedures developed should insure food products safe from bacterial spoilage and fully acceptable to consumers, and determine safe practices in using or refreezing accidentally thawed foods. The demands of both farm and urban families for information on more efficient management of time and materials in the preparation of foods for freezing require basic data not now available.
- d. Food Qualities Affected by New Methods of Heat Processing - Initiate studies to determine the comparative effects of new and different methods of cooking on food qualities and nutritive values. Such studies should include effects of rate, intensity and mode of heat application, such as effects of pressure cooking and electronic cooking and other new processes available to institutional and household users. Information as to which foods, qualities and nutrients may be improved, and which may be damaged by some of the new methods of cooking is needed to guide household and institutional (including school lunch) managers and others responsible for food service.

2. Proposals Suggested by Committee Members:

(To be developed prior to or at the committee meeting)

IV. SCHOOL FEEDING

A. Purpose and Nature of Work

The general purpose of this work is to (1) develop effective ways of using various foods to help achieve successful administration of the National School Lunch Act which requires that "lunches served by schools participating in the school lunch program under the Act shall meet minimum nutritional requirements prescribed by the Secretary of Agriculture on the basis of tested nutritional research;" (2) study the nutritive value of school meals as served to children; (3) investigate factors influencing acceptability of food and meals to children; and (4) evaluate practices in school feeding and their relation to the cost and management of school lunch programs.

B. Current Program

Current work is devoted to preparation of materials and program aids requested by the Agricultural Marketing Service for use in administering the National School Lunch Program.

School Lunch Recipes - In preparation for publication is a card file of basic and favorite school lunch recipes, in quantities to feed 100. Recipes include those issued in the past and new ones tested or developed to fill gaps. Suggested variations are given with each recipe to permit adaptation to food preferences of children and supplies of commodities. In addition, menu suggestions accompany each main dish recipe. The file is being published by the Agricultural Marketing Service for use in the National School Lunch Program.

Quantities of Food to Buy - Other studies at Beltsville and under contract are providing data needed by school lunch and institutional buyers (as well as by those responsible for revision of basic food composition tables). Quantitative yields and losses of food as purchased and prepared in practical situations are being provided by studies at Beltsville and under contract. These data are needed by school lunch and institutional buyers, as well as those responsible for revision of basic food composition tables. Market quality and methods of preparation are major factors in the yields of usable food and the economies possible. From the percentage yields, figures are being derived to show the quantities to buy for 100 servings in order to furnish the amounts of protein foods or fruit and vegetables required to meet regulations for Type A lunches.

C. Publications

The following publications supplement those listed on pages 41-44 of "Publications on Human Nutrition and Home Economics Research, 1924-1954."

Food Buying Guide for Type A School Lunches. (In press.) Cooperative with AMS.

Recipes for Type A School Lunches. (In press.) Cooperative with AMS.

D. Examples of Accomplishments

A collection of recipes was prepared in 1940 to assist in the effective use of foods being supplied to schools by the Federal Government. In 1943 this work was slanted to fit wartime rationing and available food supplies. In September 1946, in cooperation with the Department's cafeterias, 67 recipes to serve 100 were assembled, tested and published for schools operating under the National School Lunch Program. The following January a special laboratory was set up for use in developing large quantity recipes that would meet the minimum requirements for the type of lunch recommended by the Department (Type A), with particular attention to commodities made available to schools.

A conference of research leaders in child nutrition, pediatrics, public health, institution management, and education was held in 1945 to consider research needed to learn the characteristics of effective school feeding programs in the consolidated type of school and to develop methods for the study of the nutritional effect of school lunch programs.

School lunch management studies in the late 1940's were the first to relate food management methods to the nutritive value of the school lunch. Results were used by supervisory and managerial personnel as aids in providing more nutritious and acceptable meals at low cost to school children of different ages, and have stimulated study, evaluation, and improvement of local school lunch programs. Publications have provided practical help on such problems as storage for school lunch kitchen, quantities of food required for serving school lunches, and lists of small equipment needed for the school lunch.

Recommended research procedures for appraising nutritional aspects of a school lunch program were issued in 1951. Suggestions for carrying out further research of this kind include details regarding the sampling, experimental design of the study, physical examinations, biochemical tests, and dietary records. These were developed in a pilot study carried on in one community in cooperation with the U. S. Public Health Service and State and local authorities according to a plan outlined several years earlier by an Interdepartmental Committee on School Lunches.

E. Proposals for Committee Consideration. (IV. SCHOOL FEEDING)

1. Proposals suggested by Department scientists:

- a. Food Acceptance Among School Children - Initiate research on school children's acceptance of important kinds, forms and combinations of foods as a basis for improving menu plans and food buying and for developing recipes as needed. Loss of edible food through nonacceptance either at the serving counter or rejection in plate waste is a common problem in many school situations. Failure to consume school lunches as planned results in nutrient intakes that are lower than estimated needs. Better understanding of the factors affecting acceptance or rejection of nationally important wholesome foods is urgently needed by those responsible for administration of school lunch programs and food buying, as well as for nutrition education. (cooperative with AMS)
- b. Variation in Yields and Losses in Food as Prepared in School Lunch Kitchens - Initiate studies in school lunch situations, to determine losses and yields from food of different market qualities and from common methods of handling food during preparation in school lunch kitchens. Up-to-date information on yields and losses of available food is needed to calculate nutritive value of food consumed at school, in planning menus and developing recipes for school lunches and in improving the guide for quantities to buy for Type A School Lunches. (cooperative with AMS)
- c. Thawing of Frozen Meats and Poultry for Quantity Food Service - Develop safe, efficient procedures for thawing frozen meats and poultry in preparation for quantity food service. Convenience, bacteriological safety, and effect on food quality of different thawing procedures are factors which need to be investigated in order to provide safe, palatable and nutritious food for school children. The time required for bringing frozen meat and poultry to a temperature at which cooking can begin varies widely, depending upon shape and size of the pieces, the freezer temperature from which the pieces come, and the temperature and other environmental factors during thawing. Dependable guides for planning a thawing schedule are essential if school lunch managers are to avoid spoilage on the one hand and achieve satisfactory thawing on the other. (cooperative with AMS)

2. Proposals suggested by committee members:

(To be developed prior to or at the committee meeting)

V. FABRIC QUALITY

A. Purpose and Nature of Work

Research in the broad field of textiles and clothing seeks to develop facts that will (1) assist in the most effective household utilization of the country's fiber resources and (2) at the same time help homemakers solve the everyday problems of providing and caring for their families' clothing and household textiles. Thus by concentrating on household use, this research completes the chain of fiber and fabric work in the Department -- a chain which starts with fiber production studies and leads through new textile developments in utilization research to the use in the home of the finished fabric in clothing and household textiles. It also develops principles or guide lines which (1) aid homemakers in judging quality of fabrics and of design and construction of clothing and (2) furnish information on the care of these items.

The objective of the research program on fabric quality is to (1) discover the underlying principles governing the relationship of fiber, yarn, and fabric construction to the qualities of fabrics important to consumers so as to minimize undesirable characteristics and maximize desirable ones, (2) determine what combinations of yarn and fabric constructions should be used with each of the many different varieties and qualities of American-grown fibers to produce fabrics which most nearly meet specific consumer needs -- thus obtaining the facts necessary to gear more adequately fiber production to family requirements in terms of demands for products, and (3) study current market offerings of fabrics from the standpoint of their relative usefulness to consumers so as to supply needed current information to homemakers, teachers, and others working with families. Within these three broad fabric quality headings the Department's activities have been organized.

B. Current Program

Fiber, Yarn, and Fabric Structure as Related to Dimensional Stability - Having determined the construction factors which control the dimensional stability and elasticity of plain filling knit fabrics, current research is on improved dimensional stability of one type of warp-knit fabric -- tricot. Preliminary study of this fabric indicates that the relationship of wale and course spacings which were found to govern shrinkage of filling knits does not apply to warp constructions. This research, as it relates to cotton, is important from the standpoint of opening potentially larger markets for cotton and providing more useful clothing fabrics to consumers.

Serviceability as a Function of Fiber, Yarn, and Fabrics through Evaluation of Controlled Experimental Fabrics - To find the yarn and fabric constructions most satisfactory for cotton shirtings, work has been initiated on five such experimental fabrics made with varying counts, weaves, and yarn sizes. The fabrics were made by SU according to specifications formulated in cooperation with HE. Shirts made of these materials are now in service and a specified number will be withdrawn for laboratory evaluation at different wear intervals. The results of the serviceability portion of the study will be correlated with laboratory determinations of fabric properties, such as breaking strength and resistance to abrasion.

To determine the wearing qualities of domestic wools subjected to different ageing processes during manufacture, serge suitings were made with other factors held constant. Trousers constructed of these fabrics have been worn until no longer suitable for street wear. Laboratory measures of wear resistance are being compared with these serviceability findings. Promising leads have been uncovered toward the development of improved techniques for evaluating and coordinating wear test studies.

The potential usefulness of medium and coarse wool in clothing is being investigated by a comparative serviceability study of experimental whipcord suitings (2 all-wool composed of fine and medium fiber, and 4 containing different amounts of medium and coarse wool, staple rayon, and staple nylon). Trousers made from these fabrics are being worn by delivery drivers. Samples are withdrawn periodically for laboratory evaluation. The wool used in the study is of known genetic origin. All other fibers are from commercial sources.

A manuscript is in preparation reporting a cooperative study on the relationship of variety and staple length of cotton to the serviceability of percales suitable for work dresses. The fabrics were made into laboratory uniforms, and put into service at 4 colleges. Results showed that 1-1/8 inch staple length cotton was somewhat superior to cotton of 1 inch staple length. Also the number of yarns per inch had a greater influence upon length of service than did the construction of the yarn.

Serviceability of commercial staple textiles - Serviceability of cotton floor coverings in relation to their construction is being studied. Twelve medium quality cotton floor coverings secured on the open market were subjected to wear and cleaning. None of these rugs showed noticeable wear after being walked over 42,000 times. Only one-third were colorfast to washing, however. The woven rugs shrank more than the tufted rugs. As only a small number of medium quality rugs have been studied, further information is needed based on a larger number of rugs of various qualities including several types with special finishes. This work is important not only in its relation to one of cotton's largest markets, but also from the standpoint of its aid to the homemaker who is faced with choosing from an increasing variety of floor coverings available today.

Publications for homemakers on fabric quality - A revision of the bulletin "Judging Fabric Quality," first issued in 1939 and last revised in 1942 has been prepared. Almost 260,000 copies of the original bulletin had been distributed when it was allowed to go out of print because of need of revision. Continual requests are received from homemakers, extension workers, and teachers for information on this subject. The revised bulletin will discuss such topics as fibers, weaves, patterns, colorfastness, and finishes.

C. Publications

The following publications supplement those listed on pages 85-95 of "Publications on Human Nutrition and Home Economics Research, 1924-54."

A service study of twelve cotton broadloom floor coverings. M. L. Hensley and H. M. Fletcher. Jour. Home Econ. 47(2): 110-114. Feb. 1955.

Physical properties and serviceability of selected household and clothing fabrics (Bibliography and review of research findings, 1928-51). H. M. Fletcher and S. H. Roberts. Submitted for printing as Circular.

D. Examples of Accomplishment

Dimensional Stability in Knit Cotton Fabrics - Through research on plain filling knit cotton fabrics a previous unknown fact was discovered: Regardless of fiber content and other factors, the undesirable shrinking and stretching common in such fabrics are not due to their yarn properties as previously assumed but to the fact that an unfavorable relationship exists between the width (wale spacing) and the length (course spacing) of the loops in these fabrics, when relaxed by laundering or other means. These fabrics exhibit the least change in length and width when they are so made that, before laundering, their wale and course spacings follow a parabolic relationship similar to that of the laundered relaxed fabrics. By finishing fabrics of this type during their manufacture in such a way as to establish this parabolic wale-course space relationship, one of the chief deterrents to consumer acceptance of them would be eliminated. This research on filling knit goods has brought about cooperation with a task group of the American Society for Testing Materials and has contributed toward the development by that group of test methods for measuring shrinkage in knit fabrics.

Comparative serviceability of medium- and heavy-weight sheets was determined through research that yielded the first information ever obtained on the service life of bed sheets made from fibers and fabrics of known composition and construction. Medium-weight muslin sheets made from a high quality medium-staple cotton were found to wear an average of 16 percent longer than similar ones made from a lower quality short staple cotton. Heavy-weight muslin sheets made from a high quality short staple cotton withstood, on the average, between 276 and 281 use periods (periods of wear followed by laundering) while medium-weight muslin sheets made from the same grade and staple length withstood an average of 239 use periods.

Evaluation of sheetings composed entirely of cotton, entirely of staple viscose rayon, and a mixture of the two fibers was made shortly after the close of World War II, when sheets made of part cotton and part rayon appeared on the retail market. In a laboratory comparison of sheetings identical in yarn and fabric construction, those composed entirely of cotton were found to be better in breaking strength, resistance to abrasion, resistance to damage in laundering, and in dimensional stability than those composed wholly or in part of staple rayon. All-cotton sheets shrank approximately 7-1/2 inches in length; all-rayon and part-rayon, about 19 and 13 inches, respectively. This study provided the first factual information ever obtained on the comparative serviceability of cotton sheetings and sheetings from other fibers.

Evaluation of the serviceability of all-wool blankets made from three blends of wool is believed to be the first study in which fabrics, made according to specification and of wool of known history, were put into use and the rate and nature of their deterioration studied at various stages throughout their wear life. This research was reported in a USDA technical bulletin in 1937. Wool blankets containing one part virgin and two parts reworked wool had a significantly lower serviceability than those made from virgin wool. This research and a subsequent study, published in 1943, of the serviceability of blanket fabrics made from various blends of wool and mohair and additional laboratory studies of the physical properties of 44 representative household and camp blankets, formed the basis for recommended minimum specifications for household blankets that would give satisfactory consumer service.

Specifications for fabrics issued by the American Society for Testing Materials to help manufacturers produce more acceptable articles for consumers, resulted from analyses of properties of various household and clothing textiles. Among specifications developed in addition to those for blanketeting, were those for bleached wide cotton sheeting; terry (Turkish) toweling; all-cotton upholstery tapestries; medium-weight cotton corduroy; and bleached cotton broad-cloth. These specifications provided information fundamental to the factual labeling of fabrics as well as for consumer buying guides. The latter have been developed for such items as sheets, blankets, bath towels, and for cotton shirts for men and boys. Distribution of these buying guides has reached more than 2-1/2 million copies, most of which went to individuals requesting them.

E. Proposals for Committee Consideration (V. FABRIC QUALITY)

1. Proposals suggested by Department scientists:

- a. Improved Dimensional Stability and Elastic Properties of Knit Fabrics - Expand research to determine the effect of fiber length and yarn construction (twist and ply) upon dimensional stability, elasticity, and other properties of warp knit fabrics important to the user. Necessary experimental fabrics should be knit in a range of constructions sufficient to permit evaluation of the yarn and fiber combinations in terms of fabric's shrinking and stretching and its ability to return to original size and shape after stress and strain. The application of the findings from these researches by manufacturers should benefit the consumer.
- b. Fabric Construction in Relation to Serviceability of Floor Coverings - Expand research to determine the reaction to wear and cleaning of soft floor coverings now available at various quality levels. This involves evaluation of tufted and woven broadlooms, with and without special finishes, to determine dimensional and color change in use and cleaning, rate of soiling, and resistance to wear. Findings indicating the constructions best suited to specific uses in the home should aid manufacturers in improving their products and consumers in determining which of those available are best adapted to their purposes.
- c. Deterioration of Fabrics during Household Storage - Initiate research to investigate the role of heat, light, humidity, and microorganisms in the deterioration of fabrics during storage in order to aid homemakers and others in the most effective preservation of clothing and household textile furnishings. Chemical and physical changes would be determined in fabrics and garments with and without special treatment and wrappings, stored under varying atmospheric conditions and for different periods of time.
- d. Launderability of Present Day Fabrics - Initiate research to determine the effect of various cleaning procedures on the characteristics of currently available fabrics as a basis for recommending acceptable methods for home laundering. Included should be fabrics of different constructions (weight, weave, yarn combination, finish, and fiber content) and various laundry conditions (time, temperature, and washing agents). This research would be carried out cooperatively with equipment research workers.

2. Proposals suggested by Committee Members:

(To be developed prior to or at the Committee meeting.)

VI. DESIGN, CONSTRUCTION, AND CARE OF CLOTHING AND TEXTILE ARTICLES

A. Purpose and Nature of Work

The purpose of this research is to develop principles by which to judge the suitability of clothing and household textile articles for consumer use; develop designs for utility garments to meet specific needs of the wearer; conduct studies on body measurements to improve the sizing of clothing; devise improved techniques for the home construction of clothing and textile articles; and develop improved procedures for the home care of the family's clothing and textiles.

Research is done to determine the relative merits (in terms of resistance to wear) of various clothing construction features to provide a basis for choices on methods of constructing garments. Garments for women and children are designed which embody principles of self-help (for children), safety, and other functional principles. Body measurements are made to provide a basis for more comfortable and better fitting clothing and improved size standards. Nature and extent of fabric deterioration due to light, heat, and improper laundering and cleaning methods are studied to determine best methods of care and storage to prevent deterioration of textiles and clothing.

B. Current Program

Care of Clothing and Household Fabrics - To help homemakers solve new clothing-care problems research is conducted on stain removal from fabrics made of man-made fibers and from fabrics with special finishes. The methods of removing stains developed take into consideration the type of stain (fresh, heat-set, and aged) and the damage resulting from the reagents used. A manuscript in preparation will supersede Farmers Bulletin 1474, "Stain Removal From Fabrics ... Home Methods."

Research is under way on the improvement of bleaching practices in using various combinations of detergent and bleach solutions, in cooperation with household equipment research workers.

Research to determine the concentrations of available chlorine from sodium hypochloride and of a quaternary ammonium germicide which will disinfect fabrics of different fiber content has been completed. Findings show that products providing available chlorine would be the germicide of choice for cotton but that the quaternary would be preferable for wool. Research investigating fabric-volume ratios and other factors which affect the evaluation of disinfectants on fabrics will be continued because the use of germicides to impart antibacterial properties to fabrics has become widespread.

Home Construction of Clothing - Exploratory research is under way on the comparable cost of homemade and ready-made clothing. The time and money cost of making cotton house dresses similar to those that can be purchased ready-to-wear is being determined. The next phase of the research to be undertaken will be on women's cotton daytime dresses.

Research on short cut methods in home sewing has been completed and manuscripts reporting the findings are in preparation.

Publications for Homemakers Pertaining to Clothing - The necessary research has been completed and manuscripts have been prepared revising Miscellaneous Publication 688, "Buying Men's Suits," and Farmers Bulletin 1837, "Cotton Shirts for Men and Boys." At the request of the Federal Extension Service and in cooperation with the National Association of Retail Clothiers and Furnishers, 3 filmstrips related to the former bulletin have been prepared.

C. Publications

The following publications supplement those listed on pages 93-109 of "Publications on Human Nutrition and Home Economics Research 1924-54."

Desorption of quaternary nitrogen compounds from cotton and wool fabrics. M. T. Goldsmith and M. A. Latlief. To Jour. Appl. Microbiol. (In press)

Inhibition of urease by a quaternary M. T. Goldsmith. To Jour. Biol. Chem. for publication.

D. Examples of Accomplishment

Development of designs for functional clothes for women and children has resulted in new types of garments and created demands for new fabrics especially suited to the designs. In the late 1920's, two new types of garments were introduced -- sun suits that provided for direct sun rays and one-piece snow suits that simplified dressing and undressing small children. This work led to the introduction of shower-resistant cottons for the outer fabric of children's snow suits. Prior to this work such garments were entirely unknown in children's wardrobes and to the clothing trade. Today a number of manufacturers make such items and many of them use the fundamental principles of children's functional clothing developed by the Bureau of Home Economics.

During World War II, research on women's work clothing established standards of design that provided for the wearer's comfort and safety, took into account convenience in dressing and simplicity of design, and used material and construction best suited to the wear and care to the given the garment. For these, as for other functional designs developed, commercial companies have put out patterns made from laboratory patterns supplied them. Manufacturers of ready-to-wear garments have incorporated many features of the designs in their products. Teachers have made wide use of the designs and the principles on which they are based. Patterns have also been supplied to manufacturers, nursery school directors and teachers in New Zealand and Australia.

More than 250 designs for women's full-fashioned cotton hosiery, with construction details, were ready for release just as the silk shortage of World War II became critical. This work was undertaken by Congressional request to increase the use of cotton. Manufacturer s put several of the designs into immediate production. Actual wear studies on some of the designs showed cotton hosiery made of long-stable fiber pre-eminently suited to needs of nurses, waitresses, and beauty shop operators. Later studies showed that by giving yarns of short-staple cotton certain chemical finishes, hosiery could be made that was superior in appearance, bursting strength, elastic properties, and abrasion resistance to hose knit from untreated short-staple yarns.

Development of effective mildew-resistance treatments for cotton fabrics reduced the enormous yearly loss of cotton household fabrics from mildew. More than 250 chemical treatments were evaluated for their effectiveness in preventing mildew after laundering, weathering out-of-doors, and storage. As a result several treatments were developed for use on shower curtains, awnings, porch furniture fabrics, and similar items likely to mildew. A public service patent was granted for one treatment. Results of this research have also served in developing (with the informal cooperation of the U. S. Forest Service) treatments for preserving seed-bed cloth, and (with the informal cooperation of the Bureau of Entomology and Plant Quarantine) a treatment for rendering fabrics resistant to termites.

Collection and analysis of body measurements for children and women completed in 1941 provided the basis for developing a practical and scientific system of sizing garments and patterns, thereby helping to overcome waste due to misfits and returned goods. Retailers estimated that millions of dollars worth of children's clothing were returned annually to retail stores because of wrong size -- a situation resulting largely from a lack of standardization of sizes. The proposal for the improved sizing of garments was accepted by several branches of the children's apparel industry, and served as the basis for the development of Commercial Standards of the U. S. Department of Commerce. In addition to their use in the United States, results of this statistical study are being used as a guide by research workers in Sweden and The Netherlands in developing sizing standards for the apparel industries in those countries.

Development of minimum standards for clothing construction provided the basis for the section on construction in the American Home Economics Association Standard for cotton housework dresses. (approved June 1950)

Guidance in clothing conservation was an aid in keeping families comfortably and adequately clothed during World War II. During those years when the market offerings of civilian fabrics and garments, particularly those for children, were few, attention was given to devising make-overs from discarded articles. That this research met a real need is shown by many reports from homemakers and by the fact that more than one and a half million copies of publications on clothing conservation were distributed, largely upon individual request. The Extension Service made wide use of results of this research in this country. England also used them; one Department publication was reprinted in that country in the official organ of professional home economists.

Furtherance of home sewing through the development of new procedures and the adaptation of commercial techniques to the home dressmaker's equipment and facilities has helped women to produce at home garments of high quality and professional appearance, thus providing for themselves and their families clothing of better fabrics at a lower price than would otherwise have been possible. More than 7 million copies of home sewing publications have been distributed.

E. Proposals for Committee Consideration (VI. DESIGN, CONSTRUCTION, AND CARE OF CLOTHING AND TEXTILE ARTICLES)

1. Proposals Suggested by Department Scientists:

- a. Homemade and Ready-to-wear Clothing - Expand research on the comparable cost of homemade and ready-made clothing to include blouses, dresses and coats for teen-age girls. Garments representative of those available on the market would be purchased and comparable ones reproduced by seamstresses possessing varying degrees of sewing skills as the basis for determining management alternatives open to homemakers in the purchase and household production of clothing.
- b. Improved Sizing of Children's Shoes - Initiate research on the foot measurements required for improved sizing of children's shoes. Data, now lacking, should be obtained on foot measurements taking into account foot contours, as well as lengths and circumferences, in order to provide shoe lasts more conducive to the child's comfort and foot development. This research would be done in cooperation with interested home economics agencies and other interested groups.
- c. Serviceability of Children's Shoes - Initiate research to determine the relative durability of various types of shoes and their component parts as a basis for recommending to manufacturers and consumers the qualities needed for more

satisfactory performance. Information should be obtained on the resistance of shoe materials to abrasive wear and to other forms of deterioration such as moisture and bacteriological action.

- d. Durability of Seam and Edge Finishes - Initiate research to learn the causes of construction failures in clothing and household textile articles as a basis for recommending to manufacturers and homemakers the construction features needed for satisfactory performance. The durability of various types of stitch constructions, seams, and edge finishes when used with fabrics of different qualities (weight, weave, count, fiber content, and finish) should be determined.
- e. Home Laundry Finishes - Initiate research to determine effectiveness of recently developed starches, modified cellulose compounds, plastic finishes, and fabric softeners for use in home laundering. These new laundry aids should be evaluated for their efficiency in restoring the original appearance of the fabric and for their effect on fabric quality, ease of soiling, and soil removal.
- f. Physiological Requirements of Clothing - Initiate research to determine the effect of fabric composition, clothing construction, and design on comfort. The relative insulating values of different fabrics and the effect of fabric and garment construction on absorption of perspiration and retention of body heat would be among the problems attacked.
- g. Functional Clothing for the Aging - Initiate research to determine features of clothing design for the aging which contribute to comfort, convenience, safety, health, and ease of maintenance. Application by homemakers, students, and garment manufacturers of the principles developed in this research would provide appropriate and satisfying clothing for a rapidly increasing segment of the population.
- h. Clothing for Children - Initiate research to develop functional clothes for pre-school children. The inter-relation of design, fabric, and workmanship would be considered along with recent knowledge of children's abilities at various ages. Thus principles resulting from earlier work would be broadened and brought up-to-date. This research would lead to the revision of Farmers Bulletin 1778, "Fabrics and designs for children's clothes," issued in 1937.

2. Proposals suggested by Committee members:

(To be developed prior to or at the Committee meeting.)

VII. REQUIREMENTS FOR FUNCTIONAL FARM HOUSING

A. Purpose and Nature of Work

The major objectives of this research are: to determine the family-living requirements of rural housing; to develop design standards which will provide for efficiency in household operation, livability, and economy in construction; to evaluate the suitability of materials used for interior finishes; and to develop house plans well suited to family needs.

This work involves the determination of work and storage space requirements for various household activities, efficient arrangements of space and equipment, and the development of designs for functional built-in facilities, taking into account information on the type and scope of household activities of farm families and on the amount and kind of family possessions requiring storage. Different arrangements of workspace and installed equipment and various designs for built-in facilities are evaluated by motion and energy expenditure studies and other methods found applicable. Results are incorporated into house plans, and also published in technical and popular reports.

B. Current Program

Work and Storage Space Requirements - Research to develop space requirements for home food preservation and for the storage of clothing and household textiles has recently been completed. Work and storage spaces needed for home food preservation and efficient arrangements of these with installed equipment, were determined and functional designs for storage facilities were developed for the processed food, utensils, and supplies. For the storage of clothing and household textiles, unit-space requirements were determined and dimensional data for storage facilities developed. Technical publications are in preparation. Results are also being presented in graphic form for use by architects and others working with farm families in house planning.

Recently initiated research on the human energy expenditures in housework is comparing the energy costs of using equipment and storage facilities of different designs and arrangements, different types of equipment, and different methods of work. These data are needed in the development of designs for functional equipment and built-in housing facilities and for simplifying methods used in performing household activities (cooperation with equipment and nutrition research workers).

Research on space used by the human body when performing household tasks is being started in cooperation with three State Agricultural Experiment Stations as a basis for developing space standards needed in planning functional farmhouses. Measurements will be obtained of the space required for basic motions and positions of the human body when performing household tasks related to the use of major types of household equipment, furniture, and facilities.

Research to develop kitchen designs for the aged and physically handicapped has been initiated. The older population in the United States is increasing rapidly. There are over 10,000,000 physically handicapped homemakers, most of whom must continue to take care of their homes and families. Workspace and storage designs and arrangements of equipment will be developed to cut to a minimum the energy cost of kitchen activities. These designs will incorporate findings from the research under way on energy expenditures in housework and on space use by the body in performing household tasks.

Functional Farmhouse Plans - Plans for low-cost expandible-type houses are being developed in cooperation with agricultural engineers. This type of house provides for the building of a relatively low-cost basic unit adequate for a family of two or three, and which can be enlarged at minimum cost without altering the basic unit. Basic units for five of these houses have been built at the Agricultural Research Center to house families of farm employees. Two houses have been expanded to meet the needs of larger families. The experimental construction, the floor, counter, and wall coverings, and the adequacy and convenience of the arrangements of the houses are being studied.

Participation in the Regional Plan Exchange Service is continuing. In this Service, house plans incorporating the results of current research are developed in cooperation with certain Land-Grant Colleges and are published in Regional Plan Service Catalogs. The working drawings for the plans are sold in most States through the Extension Agricultural Engineer. A revision of the Southern Plan Service Catalog is nearing completion. Revision of the Western Regional Catalog has been started and existing farmhouse plans will be revised to incorporate results of recent research and some new house plans will be developed.

C. Publications

The following publications supplement those listed on pages 109-113 of "Publications on Human Nutrition and Home Economics Research, 1924-54."

Space requirements for home food preservation. M. S. Howard and G. K. Tayloe. (Submitted for publication as Tech. Bul.)

Storage space dimensions for units of household linens. A. M. Woolrich, M. A. Richards, and M. M. White. Jour. Home Econ. 47(3): 177-184. Mar. 1955.

Storage units for household linens--design data for house planning. A. M. Woolrich and J. D. Herrington. (Submitted for publication as Agr. Inf. Bul.)

Storage space requirements for household textiles. A. M. Woolrich, M. M. White, and M. A. Richards. (Submitted for publication, to be processed.)

Split-level expandible farmhouse. Leaflet 376. June 1954.

D. Examples of Accomplishment

A Nation-wide survey of farm housing conditions in 1934, covering about 596,000 farmhouses in 46 states, gave the first detailed description of farmhouses and their equipment and revealed their needs for improvements. Results of this study pointed up needs for research in various phases of farm housing and for many years served as a guide for educational programs dealing with the improvement of rural housing.

A series of planning guides entitles "Your Farmhouse" was developed to meet the demand from farm families for help in planning and remodeling in the period just after World War II. Since few researches had been made to assist in house designing for efficiency and livability, these publications were based largely on the experience and judgment of people working in the rural housing field. They were prepared in cooperation with agricultural engineers.

Forty-five plans for farmhouses were developed since World War II in cooperation with agricultural engineers, and bulletins illustrating a number of them published. These plans, distributed by states in all regions, have been widely publicized in farm magazines and local newspapers. All regions report that these farmhouse plans have been their best sellers. Plans for 19 low-cost farmhouses were developed or revised for use in the program authorized by the Housing Act of 1949. The farmhouse designs are also used by commercial organizations in preparing plans that show the use of various materials.

Functional designs were developed for cabinets used in the three major work areas of the kitchen -- meal preparation, cooking and serving, and clearing and dishwashing. These designs are simple in construction and the working drawings can be used by families doing their own remodeling and by local carpenters unskilled in cabinet work. The construction drawings are distributed through the Regional Plan Exchange Service. More than 600 sets of the drawings were sold during the first two years they were available.

A step-saving U-kitchen, developed to assist homemakers in reducing time and effort spent in kitchen activities, was based largely on studies of efficiency in arrangement of kitchen storage facilities. This kitchen was built and exhibited to thousands of people. Approximately 400,000 copies of the bulletin "A Step-Saving U-Kitchen" have been distributed. Construction plans for the kitchen are sold through the Regional Plan Service in the states, and requests for information or blueprints come from the 48 states, Alaska, Hawaii, Puerto Rico, and foreign countries. In Australia and Canada arrangements to distribute blueprints were made by government agencies.

A pioneer study of housing needs and preferences of 4,000 farm families, started in 1948 in cooperation with 29 State Agricultural Experiment Stations, made available for the first time information on the kinds and extent of household activities carried on by farm families, the major equipment used, kind and quantity of possessions requiring storage, and family preferences for housing features and locations of activity areas. This information furnishes essential basic data for the development of space requirements for household activities and for storage facilities.

E. Proposals for Committee Consideration: (VII. REQUIREMENTS FOR FUNCTIONAL FARM HOUSING)

1. Proposals suggested by Department scientists:

- a. Functional House Plans - Expand work on development and evaluation of functional farm house plans incorporating results of the recent State-Federal coordinated research program. These results include space requirements for household activities, efficient arrangements for installed equipment and built-in facilities, designs for functional storage facilities, and families' preferences for location of activities and certain housing features. With farm families now spending approximately one billion dollars per year in remodeling and building new homes, the present Regional Plan Service work should be accelerated so that a wide variety of plans are available at an early date.
- b. Materials and Finishes for Walls, Table Tops and Floor Coverings for Farm Kitchens and Workrooms - Initiate research on different types of materials and finishes for walls, table tops and floor coverings for farm kitchens and workrooms to assist families in determining which of those available are best adapted to their purposes. Information is needed on performance of these materials, especially on the recently developed types in relation to different uses, ease of installation, care, maintenance and durability.

c. Farm Household Water Requirements - Initiate research to determine total volume and peak water requirements for the farm household to provide the information needed for recommendations regarding water supply, plumbing systems, and waste disposal facilities. Because the water supply is short in many rural areas and is becoming critical in certain localities, water requirements of household activities and of different types of water-connected household equipment should be determined under conditions of home use as a basis for planning the type and number of pieces of equipment that can be operated on the available water supply. The total water requirements and peak load of farm homes should also be determined as a basis for recommendations for size of pump, storage tank, water heater, septic tank, and drain field, and to help farmers in determining the adequacy of new wells. The information will also serve in planning for conservation of water.

This work will be part of broader studies on farm water supply, sewage disposal and farm plumbing, conducted cooperatively with agricultural engineers.

2. Proposals suggested by Committee members:

(To be developed prior to or at the Committee meeting.)

VIII. PERFORMANCE REQUIREMENTS, USE AND CARE OF HOUSEHOLD EQUIPMENT

A. Purpose and Nature of Work

The broad purpose of this work is to determine performance requirements for major types of household equipment and to compare the operating characteristics, energy costs, and economy of various types and designs.

Accomplishment of these objectives involve determining the qualitative requirements of the job to be done by household equipment and the performance-in-use of various types and designs of equipment currently on the market. Based on the results, economically and structurally feasible performance standards are developed in cooperation with research workers in foods, textiles, and other home economics fields. Engineering tests are used with various types of construction and design of household equipment to determine operating characteristics under controlled conditions. Human energy costs of using different kinds of equipment are determined. Designs are developed for home-built equipment which is not available commercially or, if so, is too costly for wide use.

B. Current Program

Laundry Equipment - Research on the operating characteristics and use of household automatic clothes dryers' features of construction are evaluated in relation to such factors as the efficiency of operation, convenience in use, cost of operation, and the extent of deterioration of fabrics dried. Laboratory work is nearing completion and analysis of data and preparation of a technical report are under way. Paralleling the work on clothes dryers is a study of methods of bleaching cotton fabrics using modern laundering equipment.

Specifications for Household Equipment - A continuing area of work is the preparation of specifications for household equipment as part of the program of the Federal Specifications Board. Prepared specifications, which include (1) construction standards, (2) performance requirements, and (3) test procedures, are based on research findings of the Department and of other research agencies. These specifications are recommended as bases for new or modifications of existing standards developed by the American Standards Association, professional organizations such as the American Society of Refrigerating Engineers, and trade organizations such as the National Electrical Manufacturers Association.

C. Publications

The following publications supplement those listed on pages 113-119 of "Publications on Human Nutrition and Home Economics Research 1924-54."

Washing machines -- selection and use. E. S. Ross, K. Taube, and D. S. Green. Home and Garden Bul. 32. (In press)

Cost of electricity and liquefied petroleum gas for cooking, refrigerating, and water heating ... facts for Extension and home service leaders and others who work with consumers. E. C. McCracken and E. Beveridge. Agr. Inf. Bul. (In press)

Home freezers -- their selection and use. E. C. McCracken. Rev. of Misc. Pub. 687. (Submitted for printing as Home and Garden Bul.)

A research project ... in a home equipment laboratory. (Black and white filmstrip. Laboratory scenes from electricity and LP-gas research project). Available for loan. Jan. 1955.

D. Examples of Accomplishment

Initiation of a program to standardize testing procedures, such as is now carried on by the American Standards Association, may be credited largely to Department activities. About 20 years ago, the Bureau of Home Economics asked that a committee be set up by the American Standards Association to formulate standards for household refrigerators. This committee, in which the Bureau took leadership, was the first ASA household-equipment committee to be created.

The Bureau also developed the first test procedures proposed for home freezers, many features of which have found a place in the proposed standard test procedures for home freezers of the American Society of Refrigerating Engineers and of the American Standards Association. In addition, the Bureau cooperated in the development of American standard test procedures for electric and gas ranges, electric water heaters, and hand irons, and these tests are being used by manufacturers in developing designs for equipment.

Leadership in developing performance requirements which household equipment should meet has been taken by the Bureau. Temperature requirements for maintaining desirable quality in foods stored in household refrigerators and home freezers have been established, and industry is developing equipment to meet these. Upper and lower limits of acceptable browning have been established for products baked in an electric-range oven, and a set of color charts ranging from colors slightly lighter and somewhat darker than the acceptable limits in browning have been prepared to provide a simple, inexpensive tool for judging oven performance. The electric oven performance standard was developed in cooperation with an American Standard Association sub-committee on "Cooking Performance of Electric Range Ovens".

Buying guides and directions for use and care of household equipment were prepared to assist consumers in selecting equipment to meet their needs, using it efficiently, and caring for it properly. During World War II, a series of 8 leaflets covering important household appliances was prepared to help families extend the life of these scarce items through proper use and care. These publications also served as teaching aids in high schools, colleges, and adult education classes. In addition to a distribution of over 2,700,000 copies, they were reproduced in whole or in part in both trade and popular magazines in this country and abroad.

Design for a walk-in refrigerator was developed based on certain known functional requirements and tested under controlled conditions and actual farm use. Construction drawings with bills of materials and detailed directions for building were prepared and are being distributed through the Regional Plan Service in 43 states, Puerto Rico, Hawaii, and Alaska. With the exception of the Step-Saving U Kitchen, this plan has had the widest distribution of any in the Plan Service.

Relative efficiency of utilization of electricity and liquefied petroleum (bottled gas) by current models of ranges, refrigerators, and water heaters was determined. This information along with local rates gives the farm family the basis for making a decision as to the most economical fuel to use. The research was done under cooperative arrangement with the National Electrical Manufacturers Association.

E. Proposals for Committee Consideration (VIII. PERFORMANCE REQUIREMENTS, USE AND CARE OF HOUSEHOLD EQUIPMENT)

1. Proposals suggested by Department scientists:

- a. Home Refrigerated Storage of Perishable Foods - Initiate research to develop improved methods of refrigerator storage of perishable foods when kept together in farm home refrigerated facilities. While considerable information is available on the temperature and humidity conditions necessary for maintaining quality in individual foods, no information is available as to the most satisfactory set of temperature-humidity conditions for combined storage or ways of obtaining these conditions. In addition to determining the optimum humidity-temperature storage conditions for retaining nutritive value and palatability of farm foods stored together, emphasis will be placed on types and methods of packaging, and on methods of operating home refrigerating systems to secure and maintain these conditions. (Cooperative with specialists on food quality.)

- b. Performance Requirements of Ironing Equipment - Initiate research to determine satisfactory ironing temperatures and to develop laboratory methods for predicting the performance-in-use of hand irons and ironing machines. With the rapid development of new finishes for cotton and wool and of synthetic fibers, equipment manufacturers are asking for information on the effect of temperature on physical and chemical properties of these materials as a basis for establishing recommended ironing temperatures and the designing of ironing equipment thermostats. (Cooperative with textile specialists.)
- c. Household Equipment Costs and Returns - Initiate research on the cost of owning and operating different types of household equipment and the returns in time, money and energy saved. Consideration should also be given to the effects the equipment may have on expenditures for other goods and service. For example, in building or in remodeling houses, the installation of automatic laundry equipment may reduce the floor space needed for laundering. Such installations may also make possible a decrease in clothing inventories and the storage space required for such items.

2. Proposals suggested by Committee members:

(To be developed prior to or at the Committee meeting.)

IX. FOOD CONSUMPTION AND DIETARY LEVELS

A. Purpose and Nature of Work

The general purpose of this research is to provide the Department, research and education workers in nutrition and home economics, and the food industries with information on the kinds, amounts, and costs of foods consumed by different population groups, the practices of families in the purchase and household use of specific foods, and the nutritive content of household and national food supplies in relation to recommended amounts of nutrients. Conclusions as to the extent to which food supplies meet needs have been interpreted for use in many of the Department's programs and publications. Dietary studies also show emphases needed in nutrition programs.

Patterns of food consumption and the nutritive value of diets of population groups have concerned the Department for some 60 years. Dietary surveys are made periodically to obtain indications of the trends in and factors affecting food consumption and adequacy of diets of families. Estimates made annually of the nutritive content of the national food supply provide data on general changes in the national diet associated with changes in the production, processing, and marketing of food.

B. Current Program

Household Food Consumption and Nutritive Adequacy of Diets - A major current activity is a food consumption survey (cooperative with AMS) of a nationwide sample of 6,000 families. The survey will provide information on the food consumed during a week of the spring of 1955 by each family, with reporting of the kinds and quantities of food in enough detail to serve the needs of home economists, nutritionists, and those concerned with marketing agricultural products. Reports will be prepared on food consumption of urban, rural nonfarm, and farm families. For the farm group, separate data on purchased and home-produced food will be provided. Estimates of the nutritive content of family food supplies will be made for each group of families, classified by income.

Preparing the basic data from the food consumption survey for release, including estimates of the nutritive content of family food supplies, is expected to take the major portion of staff time assigned to this area of work for the next two years and the amount of analytical work that can be undertaken during this period with existing staff is limited. Present plans include an analysis

of changes in income-food-consumption relationships, which are used in projections of demand and therefore are important to agricultural policy, as well as indicative to home economists of consumption patterns and their implications for educational programs.

Practices in Household Food Use - Surveys in three cities have been completed and a report prepared to show family practices in the selection and use of food, the combinations in which foods are used, and the cooking preparation methods followed. Also, surveys in 4 institutions have been completed, with emphasis on food wasted. A report on these surveys is now being prepared. These data add to the understanding of the factors affecting consumption and are needed to provide a basis for estimates of the kinds, quantitative importance, and nutritional significance of losses of food between supplies available and amounts eaten. They also give a realistic basis for educational programs in the management of food in homes and institutions.

Information for Food and Nutrition Programs - Research findings are summarized and interpreted for use in community, group, and school nutrition programs and for administrative programs of the Department. Many of the facts wanted are scattered in various technical publications as results of survey and experimental work; some are unpublished; others need to be derived from available basic data and by interpretation and application of facts from different scientific fields. Topics currently scheduled for inclusion are: a guide to the selection of an adequate diet within the general pattern of food habits in this country; nutritional importance of foods, and application and use of recommended dietary allowances. From time to time, review is made of available research findings on diet and nutritional health, and results are made available to workers in nutrition education, public health, and in Federal and State programs.

The Nutrition Programs Service provides for the interchange of program information among Federal agencies and others concerned with nutrition education. Liaison is maintained with State and local nutrition committees through correspondence, occasional meetings and through the issuance 6 times a year of "Nutrition Committee News." In addition, the Nutrition Programs Service provides secretariat services for the Interagency Committee on Nutrition Education and School Lunch, an independently functioning group of representatives of Federal and quasi-Federal agencies that have programs concerned with some aspect of nutrition education or school lunch.

C. Publications

The following publications supplement those listed on pages 27-36, 39-40, and 66 of "Publications on Human Nutrition and Home Economics Research in USDA, 1924-54 (November 1954)"

Household practices in the use of foods, three cities 1953. C. Le Bovit and F. Clark (Submitted for publication as Agricultural Inf. Bul.).

Do you get enough milk? Home and Garden Bulletin 47, 8 pp., May 1955.

Nutrition Committee News, July - Aug. 1954, Sept.-Oct. 1954, Nov.-Dec. 1954, Jan.-Feb. 1955, and March-April 1955.

Nutritional Review, National Food Situation. NFS-69, Aug. 2, 1954, NFS-70, Oct. 29, 1954.

Food and Nutrition Services of Federal and Quasi-Official Agencies of the United States. Nutr. Programs Serv. ARS 61-1, 500 pp. Nov. 1954. (Rev. 1163)

Household practices in the use of eggs. C. LeBovit and F. Clark. In Poultry and Egg Situation, PES-172, pp-20-22, July 1954.

D. Examples of Accomplishment

Food Consumption Surveys - 1935-36, 1942, 1948 - The first two surveys provided information on the total population, the third on city families. The publications that have emerged from these surveys are a primary source of statistical data on family food consumption, and are widely used by economists and market analysts. In addition, analyses of the data have been used in developing programs of nutrition education and in the determination of public food and nutrition policy. For example, the estimates of civilian food requirements for World War II and the knowledge of family food habits basic to the rationing system depended on these findings. Estimates of future demands and of potential needs for food also have been derived from analyses of data obtained in these surveys.

Appraisal of Adequacy of Diets in This Country - An appraisal of the dietary situation in 1935-36, as revealed by records of family consumption, indicated important dietary weaknesses and gave impetus to the National Nutrition Program launched in 1941 as

a part of defense planning. It also pointed up the need for specific measures such as nutrition education, enrichment of bread and flour, and school lunch and other programs to get more and better food to the people with poor diets. Currently, the dietary situation is under continuous review both through periodic estimates of the nutritive value of the National food supply and through interpretations of studies of family food consumption in the light of human nutritional needs.

Evaluation of Methods of Studying Family Food Consumption - Methods of obtaining data sufficiently accurate to evaluate the quality of diets have been a continuing problem. At the request of the National Research Council's Food and Nutrition Board, a review and evaluation of commonly used methods was made in 1947. In 1948, a working conference on methods of studying food intake was held with experiment station workers who were engaged in cooperative studies of diet and nutritional status. From time to time methodological studies have been made to evaluate methods of obtaining data. The most recent publication on this subject compared the record and recall-list methods.

National Food and Nutrition Institute - As a part of its Nutrition Programs Service in 1952, with cooperation from other government agencies, a National Food and Nutrition Institute was sponsored which brought together some 400 persons from public and private agencies throughout the country to appraise progress in nutrition and to consider problems needing emphasis.

E. Proposals for Committee Consideration (IX. FOOD CONSUMPTION AND DIETARY LEVELS)

1. Proposals suggested by Department scientists:

- a. Trends in Food Consumption and Dietary Levels - Expand and accelerate analytical work on food consumption and dietary levels to make available more quickly conclusions as to changes between 1935-36, 1942, 1948, and 1955. Survey data will be available for these years when the 1955 survey is completed, but to do the analysis promptly, expansion is needed. These analyses would answer the following questions: How much has the proportion of the population with diets that do not meet the recommendations of nutritionists changed? Have differences in this respect among income groups changed? Has the pattern of nutritional contribution of different foods changed? By making these analyses and bringing the data together a reference source wanted by nutritionists, home economists, market analysts, the food trade, and the Department of Agriculture will be provided. Some retabulation of data from earlier years will be required because of new knowledge of the nutrient content of foods and human requirements for these nutrients.

- b. Variations in Dietary Patterns - Expand analytical work on the 1955 survey data on food consumption to show interrelationships in the consumption of foods and nutrients needed for programs of nutrition education, the food trades and the Department of Agriculture. Forecasts of increases in consumption of some products, as a result of lower prices, nutritional recommendations, or changes in marketing of foods, raise the question as to the effects of such changes on the consumption of certain other foods and of the net effect of such changes on the nutritive value of diets. Few analyses have been made to show the adjustments in family diets that result when unusually large or small amounts of certain foods are consumed, and the effect on the nutrient content of the diet.
- c. Household Food Stocks for Civil Defense Planning - Initiate surveys to determine kinds and amounts of food stocked in rural and urban households to aid in civil defense planning of food for people to be evacuated from target areas. A rough estimate, based on inadequate data, was made recently at the request of the Federal Civil Defense Administration in order to illustrate the problems involved. Needed are data on the kinds of food normally stocked by various population groups, the type of container or package, and the portion of the stock in freezers. Surveys should be made that will permit study of the factors affecting stocks so that projections can be made under various assumptions of attack, safety of foods, use of electricity, etc.
- d. Adjusted Estimates of Nutritive Value of Food Supplies - Initiate research to adjust estimates of nutritive value of national and family food supplies, used in Department programs and in nutrition education as an indication of the nutritional well-being of the population, by making deductions for food wasted. Supervised records of the kinds and amounts of foods discarded would be obtained from households. Currently, about 3,200 calories per capita are "available at the retail level," whereas per capita ingestion may be only 2,400 to 2,500 calories. If, as has been suggested, a large share of these uneaten calories are in fat, the loss may not be so large for other nutrients, but until demonstrated, this "gap" raises questions in interpretation of dietary findings. Knowledge of the kinds and amount of food wasted would be useful also in food management teaching, in guiding the production and marketing of food and in planning for food emergencies.
- e. Seasonality of Farm Family Diets - Initiate research to determine whether farm family diets differ with the seasons, for the interpretation of food consumption and dietary studies to nutrition education and Department programs. Dietary surveys have usually been limited to one week; because of interview problems. Seasonal interpretation of conclusions was provided for the urban population in the 1948 survey, but is not

available for farm families. It is expected that seasonal differences in consumption of specific foods, in food expense, and in nutritive value of diets would be greater for farm than city families.

2. Proposals suggested by Committee members:

(To be developed prior to or at the Committee meeting)

X. FAMILY EXPENDITURES AND HOUSEHOLD MANAGEMENT

A. Purpose and Nature of Work

To provide information on spending patterns of rural families and the factors affecting them, to review and appraise the economic situation and outlook for farm family living, and to study alternatives in the management of family resources of money, time and facilities in order to provide research-based materials for Extension workers, teachers, home economists and nutritionists in welfare agencies, economists, and others who work with families in developing their spending and management plans.

Original data are obtained on family expenditures, quantities purchased of various types of goods and services, and related practices of farm families by occasional nationwide surveys, usually in cooperation with other agencies. Because funds are not generally available for national surveys, a number of smaller consumption surveys in cooperation with various state groups and covering limited geographic areas and types of families, have been made since 1942, the last year in which a nationwide survey was conducted. Family consumption of specific commodities are also studied; in the late 40's and early 50's, considerable attention was given to the economics of clothing and housing.

The management of time, money, and other resources and the problems of family budgets are a concern of this research. The development of food budgets, begun in the early 1930's, is an important part of the program. Exploratory work has been done and is continuing on time and money costs of home production as compared with commercial production of certain goods and services.

Participation each year in the annual Agricultural Outlook Conference is a continuing function. In addition a publication presenting economic facts of concern to home economists who work directly with families is prepared quarterly.

B. Current Program

Rural Family Living Situation and Outlook - Periodic reports are issued on economic trends affecting farm family living and materials are prepared for the Annual Outlook Conference, using material from family living surveys and other sources such as the Census, the Bureau of Labor Statistics, the Federal Reserve Board, the Office of Business Economics of the Department of Commerce, the Agricultural Marketing Service and other agencies.

This is an ongoing activity, and the participation in the Annual Outlook Conference and quarterly reports on family living will be continued. However, the level of this line of work has been gradually reduced over the past seven years, chiefly because of the lack of basic data on rural family spending.

Rural Family Spending --Data on rural family living, quantities purchased and expenditures for goods and services are obtained from surveys, from family records and account books, and from other sources. These data are analysed to show differences in consumption patterns associated with various income, age, family size, and occupational groups and to measure, insofar as possible, levels of living achieved and changes in consumption practices. These data provide materials for those who work with families in developing their spending and home management plans.

Reductions in appropriations since 1948, coupled with increasing operating costs, have meant that even small surveys can be undertaken only occasionally. Within the next year the Agricultural Marketing Service is proposing a survey of farm family living expenditures, to provide revised weights for the Parity Index. An attempt will be made to obtain from this survey by special tabulations some of the data needed for a revision of "Guiding Family Spending." This publication is used in teaching programs and would be especially useful in the current expanded "farm and home unit" program of the Extension Service if it were brought up-to-date. The illustrative patterns of family spending in the current edition, for example, are based on data collected in 1942.

Management of Time and Money - Some exploratory work is being done, chiefly to determine whether it is possible to develop research-based guidelines, on such questions as the economy of producing at home or buying food and clothing, the time and money costs of prepared foods, and methods of computing replacement rates for consumer durables. The exploratory projects will be completed and results evaluated.

Consideration will be given to revising the food budgets, using the results of most recent food management research and food consumption surveys. These food budgets are used very much in Extension programs, social welfare work, and in teaching. Although some adjustments have been made to take account of changes in dietary recommendations, a basic revision is needed, in view of the great changes that have taken place in food markets and in purchasing practices. The possibility of developing food budgets that take account of the special situations of farm families will also be considered.

Commodity Source Materials for Consumer Educators - Reports are prepared on a commodity basis for the series "Facts for Consumer Education." Among topics covered for each commodity are: Nutritive value, market information, food value for money spent in comparison with other foods; selection and use of different varieties; use in family meals, and references on home preservation. Foods previously covered are tomatoes, peaches, pork, beef, milk and its products.

This is an ongoing project and continuation is planned. A bulletin on bread is just being completed, one on potatoes is in progress and additional topics will be selected in view of the basic information available.

C. Publications

The following publications supplement those listed on pages 67-84, 36-38 of "Publications on Human Nutrition and Home Economics Research in USDA, 1924-54."

Reference tables on farm family expenditures in Montana. ARS 62-1, 70pp., Nov. 1954.

Rural family living reports. FE-64, 20 pp., July 1954. FE-73, 27 pp., Dec. 1954. FE-85, 25 pp., March 1955.

Family clothing inventories and purchases...with analysis to show factors affecting consumption. M. L. Brew, R. R. O'Leary, and L. C. Dean. (Submitted for publication as Agricultural Information Bulletin.)

Bread...facts for consumer education. I. H. Wolgamot and L. J. Fincher. Human Nutr. Res. Br. (Submitted for publication as Agricultural Inf. Bul.)

D. Examples of Accomplishment

Appraisal of Materials and Methods in Research on Family Living - In cooperation with the Social Science Research Council and the Institute of Pacific Relations in the early 1930's, a source book was prepared that evaluated techniques and summarized findings on family living research. This study of family living in the United States and other countries, published in 1935, is still the basic source of such historical data. The evaluation of methods set the technical pattern for the large-scale research later undertaken by the Department of Agriculture and the Department of Labor.

Nationwide Surveys of Rural Family Spending - Surveys of rural family expenditures for the complete range of consumer goods and savings have twice been made on a nationwide scale. The Consumer Purchases Study (1935-36) provided data on income for nearly 50,000 rural families and data on expenditures and savings for more than 25,000 rural families. Findings, published in 23 volumes, have provided basic statistical information on income, expenditures, and savings that have been widely used by legislators, administrators, educators, and marketing research workers.

At the outset of World War II a second such rural survey was undertaken to provide information on then-current family expenditure patterns and levels of living, needed to answer administrative questions on civilian requirements. The rural sample of 1,800 families was smaller than for the Consumer Purchases Study, since emphasis was on reporting the over-all situation rather than providing information by regional or other groupings.

Both in 1935-36 and 1941-42, paralleled and coordinated work of the Departments of Agriculture and Labor made possible comparisons of levels of living of the rural and urban population and estimates of family income, expenditures, and savings for the total population. In addition to their original purpose of giving administrators needed information on family spending, saving, and levels of living, these data have provided materials for basic economic analyses. They have also had wide use in statistical work, as for example, supplying the family expenditure weights for the Index of Prices Paid by Farmers. A further end-product of research on family expenditures and savings is material useful to families and to those who work with families in budgeting problems. Findings of these family expenditure surveys have been used in publications on family financial planning prepared for the use of the Extension Service and for distribution to the public.

Economic Outlook for Family Living. The Annual Outlook Agricultural Conference provides a means of getting research results to rural families through home economists of the Extension Service. Annual chartbooks prepared for these conferences (until 1953) contained about 30 charts and showed the situation and recent changes in rural living conditions, as well as trends in prices and other economic conditions that affect family living. During World War II a monthly report, "Wartime family living," was issued to supply current economic information to those who work with families. These were distributed to home economists of the State Extension Services and the Farmers Home Administration and, on request, to college teachers, research workers, and administrators.

Formulation of Family Food Plans and Budgets. Developed around a dozen nutritionally significant food groups, practical food plans for families were first presented in the early 1930's, notably in the technical publication, "Diets at four levels of nutritive content and cost." Later successive editions, taking account of advances in scientific knowledge and changed food supplies, went to the public in more popular form, such as "Food for families with school children." Guidance material for teachers and social welfare workers was also prepared, such as the bulletin "Helping families plan food budgets."

E. Proposals for Committee Consideration. (X. FAMILY EXPENDITURES AND HOUSEHOLD MANAGEMENT)

1. Proposals suggested by Department scientists:

- a. Farm Family Spending Patterns - Expand research on farm family spending patterns to obtain more reliable and current information on family expenditures in various regions. Some information may be available from an Agricultural Marketing Service survey for revision of the Parity Index, but it will not be sufficient to serve the needs of home economists. Regional data for local adaptation are needed, as well as more complete information about family spending and related practices such as ownership of durable goods, protection against risk, and changes in assets and liabilities.
- b. Resource Use by Low-Income Farm Families - Analyze existing data and initiate new research to develop guidelines for use in coordinated pilot rural development programs to improve income and living conditions of families living on low-income farms. A rural development program for increasing earning capacity and improving living conditions of low-income farmers in 50 pilot counties has recently been proposed by the Department. Research-based information will be needed as to the provisions that should be made in farm development plans for family expenditures, such as clothing and food, and the extent to which farmers gain by producing farm products especially for home use, taking into account the production costs, and the nutritional needs of the families.
- c. Effects of Rural Development Programs on Living Conditions - Initiate research to determine how rural development programs affect the kind and level of living of farm families. When the rural development program is initiated, research should be started to measure the results obtained in increasing farm income and/or improving the level of consumption in the pilot areas. This will involve studies in selected areas of levels of living of farm families at the beginning and at later stages of the program.
- d. Replacement Rates for Household Durable Goods - Expand research to determine replacement rates of consumer durable goods, particularly furniture and larger pieces of household equipment in order to provide estimates needed by home economists, economists and others for assisting families in their financial planning and for estimating demand. A small pilot survey made in Wilmington, Delaware, in 1954 has demonstrated the feasibility of collecting data necessary for computing replacement rates using actuarial techniques. Because this was an exploratory study it was confined to living room furnishings. Additional studies of larger size in rural and in urban areas, and including more types of household equipment are needed.

e. Budgeting Family Clothing - Reactivate research on family practices in the purchase of clothing and of clothing inventories, in order to provide home economists, social welfare workers, economists and producers and sellers of clothing with needed information. Replacement rates, quantities of clothing owned and purchased, and clothing expenditure data are needed.

f. Rural Family Living and Outlook - Expand research on family living in order to include more information in the Outlook work of the Department for use with families in developing their budget plans. Participation in the Outlook Conference and needs for continued reporting throughout the year can be adequately met only with added research staff who specialize in various aspects of the family budget, for example, household equipment, housing, clothing, medical care. The Outlook work is receiving greater emphasis in Department and State Extension programs, so that expanded work is essential if the needs of home economists and family programs are to be served.

2. Proposals suggested by Committee members:

(To be developed prior to or at the Committee meeting)

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SUMMARY OF PROPOSALS FOR COMMITTEE CONSIDERATION

FOOD AND NUTRITION

I. Composition and Nutritive Value of Food

- a. Carbohydrates in Foods - Initiate laboratory analyses on carbohydrates in foods to replace incomplete or obsolete data that are likely to give erroneous results in diet planning and appraisal.
- b. Nutrients in New Foods - Expand analyses of nutrients in foods to obtain data on new foods and new forms of common foods which are not now included in tables of food composition.
- c. Organic Acids in Foods - Initiate laboratory analyses to determine the kinds and quantities of organic acids in fruits and vegetables which affect other nutritive values.
- d. Variation in Vitamin Content of Foods - Initiate analyses of available data on variation in vitamin content of foods to derive figures appropriate for variety, place of production and degree of maturity, as well as for types of commercial and household processing.

II. Human Requirements and Nutritional Response to Diet

- a. Physiological Availability of Nutrients from Foods - Expand research to determine the physiological availability of nutrients from foods, and the extent to which food processing, food composition and diet patterns affect availability.
- b. Fat in Human Nutrition - Initiate research to investigate the role of fat in human nutrition, such as the relationship of the amount and kinds of fat to metabolism of other nutrients, determination of desirable upper and lower limits of fat intake in various nutritional situations, and the dietary precautions needed when fat in diets is unusually high or low.
- c. Diet and Aging in Healthy Adults - Initiate research on the nutritional response to diet over a period of years by adult men and women considered to be in excellent health.
- d. Long-term Effects of Dietary Combinations - Expand research on the effect of diet in adult efficiency and premature physical impairment in laboratory animals to include more intensive observations of the nature, extent, and probable nutritional significance of the impairment.

- e. Dietary Factors Affecting Amino Acid Requirements - Expand research on the effect of type of carbohydrate in the diet on amino acid utilization to include other components of diet, and other biochemical and physical criteria of the nutritional effects.

III. Food Quality, Preparation and Preservation

- a. Improved Cooking Procedures for Commodities Presenting Special Problems - Expand basic research on the quality characteristics of certain types of meats, fruits and vegetables, which -- because of changes in production and marketing practices -- present new problems in cooking.
- b. Methods for evaluating palatability - Initiate research to develop and standardize more rapid, reliable and reproducible laboratory methods, and procedures for the sensory evaluation of food quality.
- c. Problems in Freezing "Home-prepared" Foods - Initiate research to develop improved methods and formulae for frozen home-prepared foods and to facilitate efficiency in the management of food supplies, time and labor.
- d. Food Qualities Affected by New Methods of Heat Processing - Initiate studies to determine the comparative effects of new and different methods of cooking on food qualities and nutritive values.

IV. School Feeding

- a. Food Acceptance Among School Children - Initiate research on school children's acceptance of important kinds, forms and combinations of foods as a basis for improving menu plans and food buying and for developing recipes as needed.
- b. Variation in Yields and Losses in Food as Prepared in School Lunch Kitchens - Initiate studies in school lunch situations, to determine losses and yields from food of different market qualities and from common methods of handling food during preparation in school lunch kitchens.

- c. Thawing of Frozen Meats and Poultry for Quantity Food Service -
Develop safe, efficient procedures for thawing frozen meats and poultry in preparation for quantity food service.

TEXTILES AND CLOTHING

V. Fabric Quality

- a. Improved Dimensional Stability and Elastic Properties of Knit Fabrics - Expand research to determine the effect of fiber length and yarn construction (twist and ply) upon dimensional stability, elasticity, and other properties of warp knit fabrics important to the user.
- b. Fabric Construction in Relation to Serviceability of Floor Coverings - Expand research to determine the reaction to wear and cleaning of soft floor coverings now available at various quality levels.
- c. Deterioration of Fabrics during Household Storage - Initiate research to investigate the role of heat, light, humidity, and microorganisms in the deterioration of fabrics during storage in order to aid homemakers and others in the most effective preservation of clothing and household textile furnishings.
- d. Launderability of Present Day Fabrics - Initiate research to determine the effect of various cleaning procedures on the characteristics of currently available fabrics as a basis for recommending acceptable methods for home laundering.

VI. Design, Construction, and Care of Clothing and Textile Articles

- a. Homemade and Ready-to-wear Clothing - Expand research on the comparable cost of homemade and ready-made clothing to include blouses, dresses and coats for teenage girls.
- b. Improved Sizing of Children's Shoes - Initiate research on the foot measurements required for improved sizing of children's shoes.
- c. Serviceability of Children's Shoes - Initiate research to determine the relative durability of various types of shoes and their component parts as a basis for recommending to manufacturers and consumers the qualities needed for more satisfactory performance.
- d. Durability of Seam and Edge Finishes - Initiate research to learn the causes of construction failures in clothing and household textile articles as a basis for recommending to manufacturers and homemakers the construction features needed for satisfactory performance.

- e. Home Laundry Finishes - Initiate research to determine effectiveness of recently developed starches, modified cellulose compounds, plastic finishes, and fabric softeners for use in home laundering.
- f. Physiological Requirements of Clothing - Initiate research to determine the effect of fabric composition, clothing construction, and design on comfort.
- g. Functional Clothing for the Aging - Initiate research to determine features of clothing design for the aging which contribute to comfort, convenience, safety, health, and ease of maintenance.
- h. Clothing for Children - Initiate research to develop functional clothes for pre-school children.

HOUSING AND HOUSEHOLD EQUIPMENT

VII. Requirements for Functional Farm Housing

- a. Functional House Plans - Expand work on development and evaluation of functional farm house plans incorporating results of the recent State-Federal coordinated research program.
- b. Materials and Finishes for Walls, Table Tops and Floor Coverings for Farm Kitchens and Workrooms - Initiate research on different types of materials and finishes for walls, table tops and floor coverings for farm kitchens and workrooms to assist families in determining which of those available are best adapted to their purposes.
- c. Farm Household Water Requirements - Initiate research to determine total volume and peak water requirements for the farm household to provide the information needed for recommendations regarding water supply, plumbing systems, and waste disposal facilities.

VIII. Performance Requirements, Use and Care of Household Equipment

- a. Home Refrigerated Storage of Perishable Foods - Initiate research to develop improved methods of refrigerated storage of perishable foods when kept together in farm home refrigerated facilities.
- b. Performance Requirements of Ironing Equipment - Initiate research to determine satisfactory ironing temperatures and to develop laboratory methods for predicting the performance-in-use of hand irons and ironing machines.
- c. Household Equipment Costs and Returns - Initiate research on the cost of owning and operating different types of household equipment and the returns in time, money and energy saved.

FAMILY ECONOMICS

IX. Food Consumption and Dietary Levels

- a. Trends in Food Consumption and Dietary Levels - Expand and accelerate analytical work on food consumption and dietary levels to make available more quickly conclusions as to changes between 1935-36, 1942, 1948, and 1955.
- b. Variations in Dietary Patterns - Expand analytical work on the 1955 survey data on food consumption to show inter-relationships in the consumption of food and nutrients needed for programs of nutrition education, the food trades and the Department of Agriculture.
- c. Household Food Stocks for Civil Defense Planning - Initiate surveys to determine kinds and amounts of food stocked in rural and urban households to aid in civil defense planning of food for people to be evacuated from target areas.
- d. Adjusted Estimates of Nutritive Value of Food Supplies - Initiate research to adjust estimates of nutritive value of national and family food supplies, used in Department programs and in nutrition education as an indication of the nutritional well-being of the population, by making deductions for food wasted.
- e. Seasonality of Farm Family Diets - Initiate research to determine whether farm family diets differ with the seasons, for the interpretation of food consumption and dietary studies to nutrition education and Department programs.

X. Family Expenditures and Household Management

- a. Farm Family Spending Patterns - Expand research on farm family spending patterns to obtain more reliable and current information on family expenditures in various regions.
- b. Resource Use by Low-Income Farm Families - Analyze existing data and initiate new research to develop guidelines for use in coordinated pilot rural development programs to improve income and living conditions of families living on low-income farms.
- c. Effects of Rural Development Programs on Living Conditions - Initiate research to determine how rural development programs affect the kind and level of living of farm families.

- d. Replacement Rates for Household Durable Goods - Expand research to determine replacement rates of consumer durable goods, particularly furniture and larger pieces of household equipment in order to provide estimates needed by home economists, economists, and others for assisting families in their financial planning and for estimating demand.
- e. Budgeting Family Clothing - Reactivate research on family practices in the purchase of clothing and of clothing inventories, in order to provide home economists, social welfare workers, economists and producers and sellers of clothing with needed information.
- f. Rural Family Living and Outlook - Expand research on family living in order to include more information in the Outlook work of the Department for use with families in developing their budget plans.